THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL.

VOL. 29. Thursday, June 19, 1924. No. 409.

PUBLISHED WEEKLY.

Subscription Terms: 15s. per annum.
Foreign and Colonial, 17s. 6d. per annum.
All Subscriptions are payable in advance.

All communications to be addressed to the Editor, or to the Publisher, as the case may be, of

THE FOUNDRY TRADE JOURNAL,
BESSEMER HOUSE, 5, DUKE STREET, ADELPHI,
LONDON, W.C.2.

Contents.

	PAGE
The International Foundry Exhibition	501
The International Foundry Trades' Exhibition, Bingley Hall, Birmingham	502
The Institute of British Foundrymen—Annual Conference at Newcastle	509
Simple Expansion Bit	514
The Formation of Graphite in Cast Iron	515
Economical Melting with Cupolas	522
Desulphurising Coke with Steam	524
Trade Statistics	524
Trade Talk	532
Mr. H. A. J. Rang Resigns Honorary Secretaryship	532
Correspondence	532
Obituary	532
Iron and Steel Markets	534

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN AND THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION.

Institute of British Foundrymen.

PRESIDENT, 1924-25, R. O. Patterson, Blaydon-on-Tyne.

LIST OF SECRETARIES—

General Secretary: W. G. Hollinworth, 38, Victoria Street, London, S.W.1.

Lancashire: T. Makemson, 21, Beresford Road, Gorse Hill, Stretford, Manchester.

Birmingham: H. James Roe, 33, Herbert Road, Bearwood, Birmingham.

Sheffield: R. Village, Albion Foundry, Whittington Moor, near Chesterfield.

Scottish: J. Bell, 60, St. Enoch Square, Glasgow.

London: H. G. Sommerfield, Charterhouse Chambers, Charterhouse Square, London, E.C.1.

Newcastle-on-Tyne: H. A. J. Rang, 2, St. Nicholas Buildings, Newcastle-on-Tyne.

East Midlands: H. Bunting, 17, Marcus Street, Derby.

Coventry: J. M. Meston, 37, Melville Road.

West Riding of Yorkshire Branch: A. Love, 232, Gladstone Street, Bradford.

Wales and Monmouth Branch: J. J. McClelland, M.I.Mech.E., Druslyn, Bishops Road, Whitechurch, Glam.

Welsh Engineers' and Founders' Association.

Secretary: F. J. Griffiths, 20, Fisher Street, Swansea.

The International Foundry Exhibition.

To-day sees the opening of the fourth European attempt at Bingley Hall, Birmingham, to place before the foundry public a representative collection of the latest equipment and material under one roof. It is to be opened by Mr. R. O. Patterson, the President of the Institute of British Foundrymen. The first was held in 1921 at Liege, the second in 1922 in Birmingham, the third, last year, in Paris. Those held in Birmingham have so far been the most comprehensive, and the present one contains several unique features. For the first time, a certain amount of German plant is being shown, and, additionally, it marks the first public exhibition of the sand-slinger. The hydraulic method of moulding, though well known and appreciated in Europe, is shown to have incorporated many minor improvements which will increase their already fast rate of operation. The pneumatic-electric and jarring, jolting, with or without pattern-drawing mechanism, constitute, with the other types mentioned, undoubtedly the finest show of moulding machines that has ever been exhibited to the British public. The show of cupolas this year is not so large as on the previous occasion, but one foreign type contains several novel features.

Because of the new proposed grinding and fettling regulations, there is a unique show of sand-blast apparatus, which will undoubtedly be the centre of attraction for many foundrymen.

Whilst the automobile foundries represent the latest practice so far as moulding boxes are concerned, the majority of foundries still have much leeway to make up. Several firms showing specialise in the light-steel section variety, which are capable of replacing economically the thousands of small yet heavy cast-iron ones we still see in too many foundries. The moulding sands being shown, typify almost every important geological deposit in England. It is a matter of regret that high railway rates so often preclude a foundry using the best sand for their work. However, this matter is having the attention of quarries which are also improving their methods of mining and transport of which the foundries will ultimately derive some benefit. Oil and sand mixers are well represented, and to those foundry managers who imagine they can mix as well and economically by hand we commend their special attention, feeling sure their opinions will be changed. Sand mills, which were not extensively shown in 1922, are specially treated by one firm, who exhibit a mill which embodies quite new principles. Quite a number of the best known core-oils are being shown, and opportunities will be afforded for the close comparison of the results obtained, as numerous cores, all of "exhibition" quality, which renders them comparable, are available for handling. At least one firm has a core-maker present for making up any core from visitors' own core boxes.

On the scientific side two firms are showing metallurgical microscopes. We advise visitors to bring along their own polished and etched micro sections to try them under the latest conditions and compare the results with those given in their own laboratories.

Ladles are fairly well represented, and one which has an air-cooled belt and machine-cut gearing provided with ball and roller bearings running in an oil bath is of special interest. A cupola tapping device is another specialty, shown for the first time in Great Britain.

Amongst other features to be noted are: Pig-iron; coke; a foundry floor dressing machine; a cylindrical loam and straw-rope core making machine; sausage core-making machines; non-ferrous metals and alloys; a plastic wood confection for making fillets; refractory bricks of all kinds; and an electrically-heated core oven.

It is pleasing to note that a few small engineering specialities are being shown, such as small grinders and belt fasteners, and it can be taken as an omen that at last general engineers' suppliers are awakening to the fact that the foundry trade constitutes a large and important market for many of their wares.

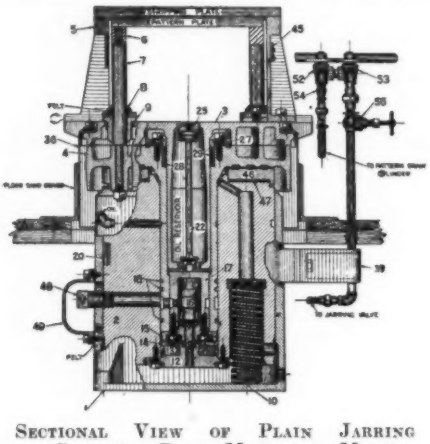
Oils, greases, nuts, bolts, hacksaws, chisels, and a hundred other small supplies are consumed by foundries in large quantities, but apparently the manufacturers have not yet realised the fact.

The International Foundry Trades' Exhibition.

BINGLEY HALL, BIRMINGHAM.

The International Foundry Trades Exhibition, which opens to-day at Bingley Hall, Birmingham, is the second of the series, the first of which, held two years ago, was an outstanding success. The present show is being carried out on exactly similar lines but with a widened scope, as a certain amount of German material is being shown through their British representatives. The stand of THE FOUNDRY TRADE JOURNAL is centrally situated, and its representatives will be pleased to welcome both advertisers and readers. The Exhibition is thoroughly representative of the latest foundry plant and materials, and covers the whole field from raw materials preparation through to the finished material.

A number of competitions are to be held for moulding, pattern-making, and core-making, for



SECTIONAL VIEW OF PLAIN JARRING STRIPPING PLATE MACHINE. MESSRS. MACNAB & COMPANY.

which valuable prizes are promised. A technical foundry congress is to be held next Wednesday, Thursday, and Friday, at which a number of original technical papers are to be read. The Exhibition has the support of no less than 24 scientific, technical, and trade associations, including the Institute of British Foundrymen and the British Cast Iron Research Association.

The following is a detailed description of some of the more important exhibits:—

Messrs. Macnab & Company.

Mesars. Macnab & Company, of London, are exhibiting a few of the many different types of their well-known Tabor patent foundry moulding machines. These are operated by compressed air, and their salient features are the freedom from ground shock during the jarring operation, speed of operation, and flexibility to take any size moulding boxes within the load capacity of the machines. The "Shockless" jarring feature is of definite importance in all foundries, as no shock or vibration is transmitted to the foundations or surrounding ground; moulds can be made and cores set adjacent to the machine whilst the machine is in operation. This applies to all sizes of boxes up to 35,000 lbs. weight. All machines have been designed with full consideration of modern foundry conditions, and also to make each type as wide in its application as possible without prejudice to its output and efficiency. Valves are enclosed in the centre of the machine and are therefore immune from grit, sand, etc., and the oiling is automatic.

Portable Combination "Shockless" Jar Ramming and Power Roll-Over Pattern Drawing Machine.

This machine is made in two sizes to handle loads of 450 lbs. and 800 lbs. weight of sand, pattern, pattern plate, and box. The former has a pattern draw of 8 in. and the latter 10 in. These machines will "shockless" jar ram, roll over, vibrate, draw pattern, and roll back the pattern ready for the next box in a time not exceeding 1½ minutes. The pattern board simply rests on the jarring table and is held in position by means of two dowel pins, thus enabling patterns to be changed instantly without unfastening any mechanism—making possible the economical production of *small* as well as large quantities. The machines are mounted on wheels, and being portable, can be transferred to any position required.

Power Squeezing "Split Pattern" Power Draft Moulding Machine.

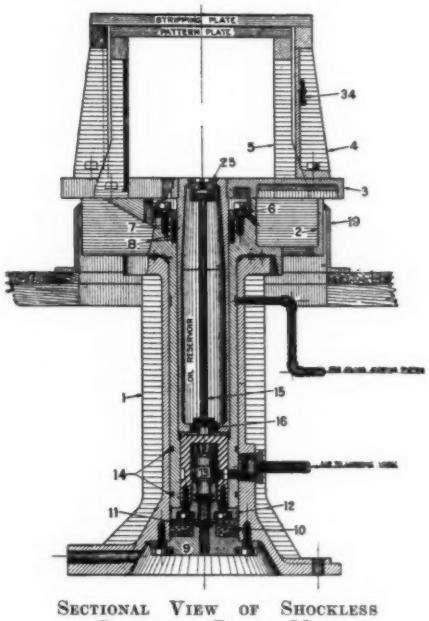
This machine is particularly adapted for making moulds from symmetrical patterns, split through the centre, or flat back work, but any pattern that can be split on a true plane can be moulded from. The boxes on these machines are not jar rammed, but squeezed to a definite pressure by a cylinder thrusting against an overhead yoke. The pattern is then automatically vibrated and withdrawn by a specially controlled cylinder acting upon a skeleton frame supporting the box, the total time required for making a complete half mould being less than 30 seconds. The machine is very simple to operate, and all the operations are controlled by one lever. This machine is made in 15 different sizes.

Power Squeezing Bottom Ramming "Split Pattern" Moulding Machine.

This machine is an adaptation of their well-known "split pattern" machine, the "bottom ramming" feature being added to enable both cope and drag patterns to be moulded in one moulding box at the same time for stacking and pouring.

Power Squeezing Moulding Machine.

This machine is specially suitable for light snap flask work, and is for boxes up to and including 14 in. × 20 in., or the equivalent in area, at



SECTIONAL VIEW OF SHOCKLESS STRIPPING PLATE MACHINE. MESSRS. MACNAB & COMPANY.

80 lbs. air pressure. The sand in the boxes is squeezed to a proper density between a cylinder head and an overhead yoke. The machine is complete with a vibrator frame for vibrating the pattern whilst it is being drawn, and can also be used with aluminium match pattern plates. It is very fast, and can show at least 20 to 30 per cent. increase over hand-squeezing machines.

"Shockless" Jarring Stripping Plate Moulding Machine.

This machine is designed for use in connection with patterns from which the mould can be lifted

without any stripping plate, or with a stripping plate that only follows the outline of the pattern and does not require stools. Pattern plate with patterns is fastened to the machine table, and after the mould has been jar rammed, compressed air is admitted to the stripping-plate cylinders, which rise and by means of stripping posts strip the pattern from the mould. Stripping posts are carried on the stripping frame and are adjustable for different lengths and widths of pattern plate, thus covering a wide range of box sizes. The machine is open on all sides, and consequently the limiting feature is the total weight to be handled up to 500 lbs., including pattern, pattern plate, stripping plate, box and sand, at 80 lbs. air pressure. As the jarring mechanism of the machine is "shockless," it requires no special foundation and is equipped with a high-speed internal jarring valve, ensuring rapid operation, effective ramming, and economy in air consumption.

Plain "Shockless" Jar Ramming Machine.

This machine is made in six different sizes for working loads ranging from 2,000 lbs. to 35,000 lbs. The "Shockless" feature works on the principle of a falling table striking a rising anvil in mid-air. The momentum of the rising anvil is substantially equal to that of the falling table at the instant of impact, and as a result both table and anvil come together with greater jarring or ramming effect upon the sand, but without shock or jar on the foundation or on surrounding material, this being due to the blow being struck in mid-air. Any size moulding box can be used on these machines, provided the total load specified for each size is not exceeded. A further advantage of this type of machine is that only a few inches of concrete are necessary for the foundation, as distinct from the plain jarring machine, which delivers the entire blow upon the foundation.

Plain Jarring Machines.

Made in three sizes—3, 4 and 6 in. for loads of 300, 700, and 1,000 lbs. at 80 lbs. air pressure. These machines are specially suitable for any large, deep work, or castings of any kind in which the ramming time is worth saving. Also for the ramming of large cores, and any mould (large or small) can be rammed up in a maximum time of one minute or less. Solidity in construction and freedom from vibration in the jarring table, with the consequent avoidance of the sand becoming broken or laminated, are its special features. It is also designed for economy in air consumption.

Tylor Patent Crucible Melting Furnaces.

These furnaces are eminently suitable for melting all non-ferrous metals, and are amongst the quickest melting furnaces, combined with economy of fuel, on the market. They are made in two sizes—the 200-lb. pit type and 400-lb. tilting type.

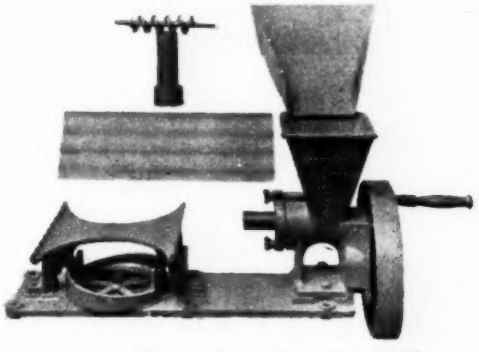
Spermolin, Limited.

Messrs. Spermolin, Limited, of Halifax, the makers of the well-known core oil "Spermolin," are showing, in addition to interesting examples of oil-sand cores, their patent rotary core machine and sand-mixing and milling machine.

This firm were the pioneers of the core-oil industry, having been established in 1908, and as the result of continued experimenting they have now on the market five grades of core oil to meet the varied needs of foundrymen. They are showing some interesting exhibits in the form of cores and moulds for use in connection with the making of sectional boilers, motor cylinders, steam cylinders, etc.

The Spermolin patent rotary core-making machine is of the sausage-machine type embodying several improvements, amongst which is the patent rising and falling tray carrier, which instantly adjusts the tray to the exact level of the die, obviating unnecessary packing and wedging and preventing bent or distorted cores. The machine is of high-grade finish, the gears being machine cut and adequately guarded. All the dies are ground, polished and guaranteed accurate, and will make round or square section cores from $\frac{3}{8}$ in. up to $2\frac{1}{2}$ in.

The Spermolin sand-mixing and milling machine has filled a long-felt want in the foundry, in that its capacity meets the needs of the average foundry. Previously there had only been small bench mixers and large machines which were only suitable for very large foundries. The machine is cast in high percentage semi-steel cast-iron ensuring longer life, with outside sand-proof bearings. All gears are machine cut and adequately guarded, and the whole is of machine-tool finish. All classes of foundry sands can be mixed and milled, and one



A SAUSAGE-MACHINE TYPE CORE-MAKING MACHINE. MESSRS. SPERMOLIN, LIMITED.

of the chief advantages claimed is that the machine completely empties itself without tilting. The Spermolin sand-mixing and milling machine thoroughly mixes one barrowful of sand in four minutes. It is a well-known fact that oil-sand cannot be properly mixed by hand, and not only does this machine give a satisfactory mix in a short space of time, but 20 per cent. less oil is required. The stand will be in charge of Mr. Norman F. S. Winter.

John Williams (Birmingham Sand), Limited.

Most foundrymen are familiar with Birmingham Cemetry moulding sand, which is the principal feature to be shown by this concern, whose registered office is at Icknield Square Wharf, Birmingham. The quarries are at 92, Summer Hill Road, Birmingham. The samples exhibited cannot fail to impress foundrymen of the variety of sands now necessary to meet the complex requirements of modern practice. Thus this firm show, in addition to the Birmingham sand, Mansfield, Gornel, Trent, Moxley, silver sand, blasting, sharp and sea sand, wet and dry ganister, limestone, fireclay, red clay, coal dust, charcoal, and various types of blackings are specialities of the firm which call for the attention of all interested in foundry practice. A special sand is shown for the manufacture of pattern plates, which should meet a long-felt need. The stand is in charge of Mr. J. G. Williams, the managing director.

W. & C. Pantin.

The exhibit of this firm, whose offices are at 147, Upper Thames Street, London, E.C.4, is very interesting and consists of a gravity roller conveyor. This arrangement appears to be a real labour-saver for foundries, as it is capable of handling economically pig-iron, bricks, moulding boxes, and some types of castings. The firm specialise in conveying and elevating equipment generally, a proposition which, so far as foundries are concerned, present their own peculiar difficulties.

They are represented in Birmingham by Messrs. James Turnbull & Company, Limited, of 3, New Street, Birmingham, who will take care of their exhibit.

J. W. Jackman & Company, Limited.

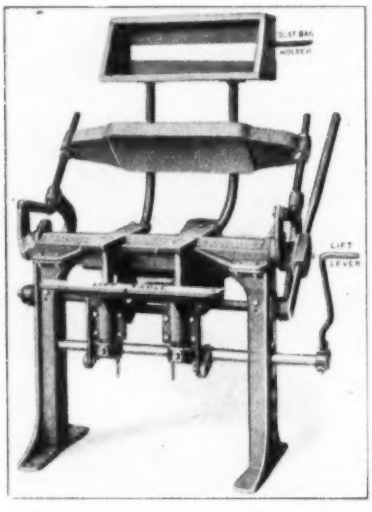
The exhibit of Messrs. J. W. Jackman & Company is a selective one taken from the permanent exhibition at the Manchester works (Vulcan Works, Blackfriars Road), and includes labour-saving machines representing many branches of the foundry industry.

Attention has been given to choose appliances applicable to as many classes of castings as possible having regard to the great variety of work met with in different foundries. For example, in the moulding machine section, machines are shown for miscellaneous jobbing work, with only a few off each pattern, as also machines for repetition work.

XUM

Moulding Machines.—The well-known jolt-ram machines of the Mumford and Osborn types are shown in variety, including those having quite unique features effecting the handling of boxes and finished moulds, and accurate pattern draw.

For general work of wide range, and where quantities of castings required from each pattern

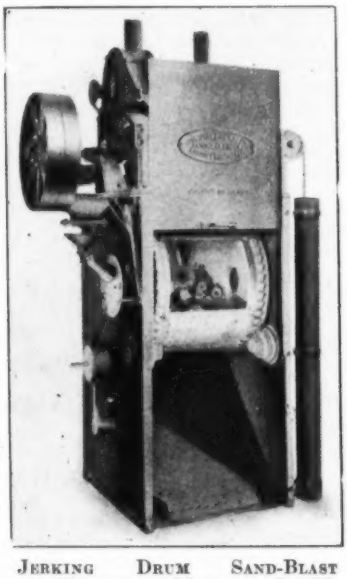


30-IN. FARWELL TYPE UNIVERSAL MOULDING MACHINE. MESSRS. J. W. JACKMAN & COMPANY, LIMITED.

vary from one to many, the Mumford type jolter provides a simple and fast working appliance.

The chief features are great impact surface of jolting table on the anvil block, elimination of any necessity to fasten boxes and patterns to the table, absence of complicated mechanism and low air consumption.

The machine shown is fitted with box stripping attachment, which comprises a heavy section yoke carrying the lifting pins, and two cylinders with pistons, one at each side of the machine, fixed to the underside of the baseplate frame. The movement of the two pistons is synchronised by means of connecting links and a back horizontal shaft in the baseplate frame.



JERKING DRUM SAND-BLAST MACHINE. MESSRS. J. W. JACKMAN & COMPANY, LIMITED.

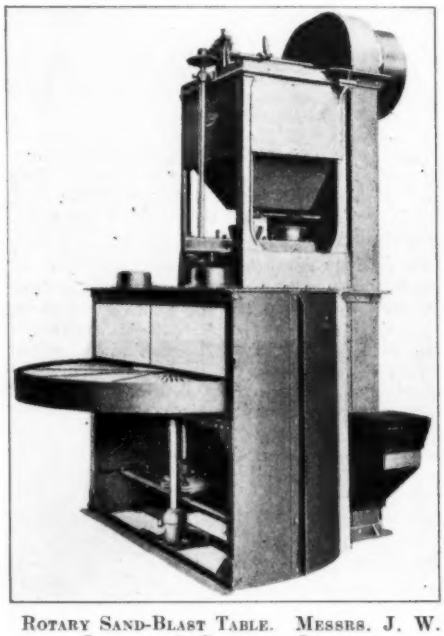
As a result the draw is steady and accurate, a truly balanced lift being effected. The yoke carrying the lifting pins is arranged with a three-way slot at each corner, so as to give wide range of positions, and thus accommodating various sizes of boxes on any size of machine.

In the No. 402 Osborn type roll-over jolter to take boxes up to 36 in. sq. features are embodied in the design not found in any other type of machine.

After the mould is jolted—the jolt cylinder being fitted with a readily adjustable compression valve to vary the length of stroke at will—it is rolled over entirely by power, the same valve being used for control that is used to effect the draw.

An ingenious levelling device to secure true alignment of mould during the draw is furnished by a special levelling carriage which is swung under the mould after the latter is rolled over. This levelling device is fitted with pins, each independently depressed as the mould is lowered on to same, and all locked by a single handle. The draw is truly vertical, the pattern being drawn upwards out of the mould. No side play or backlash takes place, the two side rods carrying the roll-over table being of ample proportion. Upon the withdrawal of the pattern the carriage is swung out from the machine and the roll-over table rolled back by power ready for the next mould. The machine is complete with clamps, vibrator, oilers, etc.

A smaller machine to take boxes up to 24 in. by 30 in. of the Osborn roll-over type is the No 401, having a similar arrangement to the No. 402



ROTARY SAND-BLAST TABLE. MESSRS. J. W. JACKMAN & COMPANY, LIMITED.

but with roll-over table swung over by hand. Made of special aluminium mixture and arranged with a shallow off-set, the table can be rolled over quite easily. One valve controls jolting and pattern draw, with the latter in two stages—one "slow" the other "fast."

For repetition work for boxes up to about 13 in. by 18 in. the Mumford type split pattern jolt press is shown. With this machine moulds are jolted and flat-rammed, and by two separate cylinders located diagonally to the table, the finished mould is drawn from the pattern plate. The control valve for this effects a slow hand draw to commence, thus opening a pneumatic valve for speedy completion of draw.

The presser head is counterbalanced, and the machine is complete with vibrator, blow-off valve and pressure gauge.

Another jolt-press machine is the Osborn Type 75.J. for use with existing pattern plates and snap flasks.

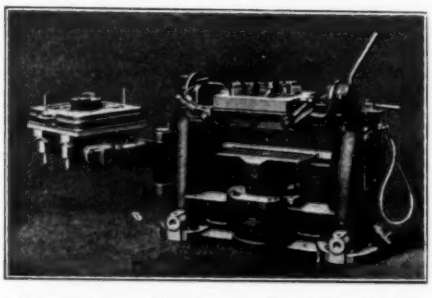
This machine jolts and flat rams the moulds, and is complete with vibrator. A special feature is the compression valve, by means of which any set of top parts can be rammed at a uniform pressure, irrespective of the pressure in the air line. A development of the 75 J. Osborn jolt press is the 75.J.S. jolt press stripper, having features of a special character.

After the mould is jolted and flat-rammed, the pattern is automatically withdrawn downwards from the mould immediately the pressure against the presser head is released. This action is similar to that in the well-known Pridmore machines, and is controlled simply by the release of the press handle. By a foot-pedal the box-carrying frame subsides into its normal position around the pattern plate ready for the making of another mould.

The Mumford-type yoke head press is a simple press machine for small work. Having a pneumatic cylinder of 10 in. dia., a uniform and steady pressure can be exerted, giving a speedy ramming action. The mould is stripped from the pattern plate by four pins engaging with the underside of the box and operated by hand lever.

This is a plain machine to utilise existing patterns and boxes, and is complete with vibrator, blow-off valve and pressure gauge. A hand machine is shown of the well-known Farwell type, comprising a vertical press action with box stripping device to lift the finished mould from the pattern plate.

Sand Blast Machines.—Three types are shown. The largest is a rotary table machine, with a table 72 in. diameter, particularly adapted for castings or articles of a flat character of any size up to the limit of the table. The table is continuously rotated slowly by power, and over same are two sand blast nozzles, each of which rotate, and are set at an angle as to ensure an effective spraying of the abrasive on the articles to be treated. A bucket elevator conveys the abrasive to the hopper



OSBORN JOLT ROLL-OVER PATTERN DRAW MOULDING MACHINE. MESSRS. J. W. JACKMAN & COMPANY, LIMITED.

above the nozzles, and by means of the grids forming the rotating table and a sieve below it, the used abrasive material is sieved and falls back along a chute to the foot of the elevator and is used over and over again.

The table is completely covered with castings or articles which upon one revolution of the table are turned over so as to present the other side for treatment. A rubber curtain across the table allows the castings to pass under the nozzles, and at the same time prevents the escape of sand or dust to the outside of the machine.

Dust is collected and removed from the machine as created, and conveyed away through two openings to ducts. All gearing is completely enclosed, and all mechanism is driven from a single belt pulley.

The jerking drum sand blast machine, another self-contained machine, is for the treatment of small castings and articles. The drum proper is made up of perforated steel plate body with cast-iron end plates, and by means of ratchet and pawl gear is slowly and intermittently rotated. This motion, together with suitable deflectors inside the drum, effect a "churning" of the castings so as to present all their surfaces to the action of the blast. Two nozzles are fitted, one at each end of the drum, and the abrasive material is continuously fed to same by means of a bucket elevator. As in the rotary table machine, the abrasive material is used over and over again. Quick discharge of the treated castings is made through a cover in the body of the drum, and thence on to a front slide, which is counterbalanced.

A small sand blast cleaning chamber meets the need of an inexpensive installation of very simple character.

It consists of a chamber in the upper part of which the sand blasting is done, the lower part covered with grids, and a sieve forming a reservoir for the abrasive material.

The nozzle may be fixed or portable, and the castings or articles readily handled inside the chamber by the operator putting his arms through sleeve armlets in the door.

The work is readily inspected through a gauze-covered opening in the door.

A patent self-sealing valve under the reservoir permits of a continuous flow of abrasive material to the nozzle, while the abrasive material is used over and over again. Dust is exhausted from the top of the chamber.

General.—In all machines there is embodied the unique feature of the suction system whereby any external pressure chamber is eliminated altogether, each machine constituting a self-contained unit. By this means friction is absent, air and abrasive material passing along separate pipes, and the air required does not vary as the nozzle tips wear.

Core Shop Equipment.—This includes the well-known Wadsworth core machine for making regular cores up to 7 in. dia. and up to 24 in. in length. All cores are vented as made, and rodded cores can be produced in the machine. A bench jolter of the Mumford type is shown for dealing with irregular cores, small and large. A distinct feature of this machine is that the core-boxes are not fastened to the table during jolting.

A motor-driven sand kneader and mixer is shown for thoroughly mixing and toughening sand mixtures of all kinds. Two paddles of special shape are fitted in the body of the machine, and rotate at different speeds. The mixture can be readily discharged by merely tilting the body of the machine by means of a handle, the paddles still rotating.

Metal Recovery.—A special electro-magnetic separator is shown for extracting iron and steel from brass borings, turnings, etc.

The Vulcan Ball Cinder Mill provides a simple and efficient method of securing the valuable metal from brass ashes, sweepings, swimmings, etc.

It consists of an inner cast steel drum of special composition, with balls that thoroughly break up and powder the non-metallic materials.

A scouring drub around the grinding drum and a further drum made up of steel sieves effect the separation of the metallic and non-metallic materials, the latter being continuously discharged at the base of the machine.

The metallic material that cannot pass through the sieves is retained in the grinding drum, and upon reversing the direction of rotation is discharged through the hollow bosses of the driving pulleys.

The machine is totally enclosed with sheet metal casing, and is provided with dust exhaust at top.

The recovered metal can be taken directly to the furnaces for remelting.

Testing Machines.—The well-known Brinell hardness testing machine is shown, this being the original apparatus for hardness testing.

In addition, a contraction and chill apparatus is demonstrated, a method of test that furnishes valuable data in the production of iron castings.

Air Measurement for Cupolas.—A new blast meter is shown for the continuous determination of air actually passing along the air main to the cupola, also a new type of blast pressure gauge. Amongst a number of small foundry accessories will be found steel moulding boxes, and several styles of pneumatic vibrators up to 2 in. diameter that can be operated at any air pressure.

The stand is in charge of the chief sales engineer, Mr. H. E. Warner, assisted by representatives Mr. A. Sutcliffe (Lancashire and N.E. Coast), Mr. W. H. Littleton (London and South of England), Mr. Mercer (manager, requisites department), and demonstrators. The directors of the Company, Mr. John Sugden, Mr. W. Rawlinson and Mr. S. E. Garratt, will also be in attendance.

Atlas Preservative Company, Limited.

The Atlas Preservative Company, of Windmill Lane Wharf, London, S.E.8, specialises in preservatives for metals, and since the rapid destruction by rust of iron and steel work in and around the foundry is such a serious and persistent

problem, foundrymen in general will find much of interest in this Company's exhibit.

They manufacture an anti-corrosive paint called "Atlas Ruskilla," which they claim is especially suited to protect structural work from the deleterious effect of acid fumes and high temperature—the root cause of foundry rust.

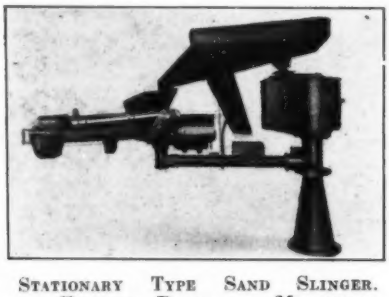
They point out that another essential feature of this paint is that it absorbs and neutralises the rust particles present at application, thus preventing further formation underneath the covering—a common feature with many so-called anti-corrosives. The paint is elastic in character, so that it does not chip or crack with temperature variation, but expands and contracts with the metal.

"Ruskilla" is very economical in use, one gallon being sufficient to cover 700/900 sq. ft. It is easy to apply, and dries quickly with a good glossy finish.

The manufacturers' claim that this paint will stand up to abnormal conditions is substantiated by specimens, photographs and a long list of satisfied users.

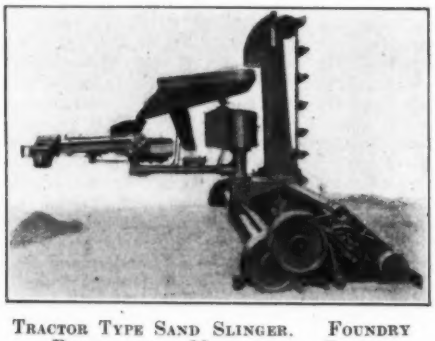
Foundry Plant and Machinery, Limited.

This firm, whose office is at 28, Royal Exchange Square, Glasgow, are confining their exhibit to the Beardsley-Piper sand slinger moulding machine. No foundry invention of recent years has created such a stir as this machine. It is made in two main types—the stationary and tractor. The latter travels into the sand heap under its own power, collecting the sand from the floor by means of a right- and left-hand sand-



STATIONARY TYPE SAND SLINGER. FOUNDRY PLANT AND MACHINERY COMPANY, LIMITED.

cutting screw conveyor. It conveys the sand by a bucket elevator to a riddle, which collects the scrap and deposits it into a scrap box mounted on the main arm. The riddled sand is conveyed by the oscillating riddle into a hopper mounted on the impellor arm, above a belt which conveys the sand into the impelling head. This discharges the sand with centrifugal force at the rate of 10 cub. ft. of rammed sand per min. The stationary type requires an extraneous conveyor system to deliver

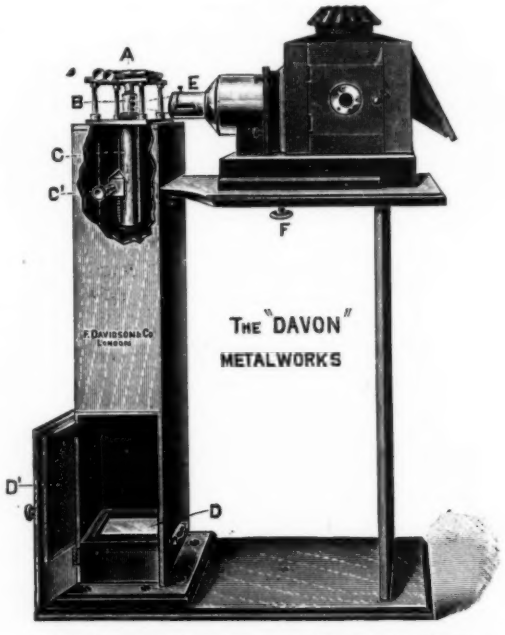


TRACTOR TYPE SAND SLINGER. FOUNDRY PLANT AND MACHINERY COMPANY, LIMITED.

to it riddled sand. A modification of this type is the portable sand slinger. As this machine is still a novelty, the Exhibition presents an excellent opportunity for foundrymen to make themselves *au fait* with its mechanism and possibilities. The stand is in charge of Mr. Daniel Sharpe, the general manager of the company.

F. Davidson & Company.

This house, whose head office is at 29, Great Portland Street, London, W.1, specialise in metallurgical microscopes. They are showing a super-microscope, which was fully described in our issue of March 27. It will be remembered that the principle of this instrument is the employment of either a second microscope or a second objective on the image formed by another objective. This is made possible by the interposition of another lens system. This system allows of the clear production of micro-photographs



A MICROSCOPE DESIGNED FOR REPETITION WORK. MESSRS. F. DAVIDSON & COMPANY.

at the highest magnification. This firm cater for the rapid production of micro-photographs by the instrument known as the Davon metal works outfit, which is supplied to give magnifications ranging from 50 to 500 diameters. It permits of the taking of 100 photographs per hour. Another interesting exhibit is the microtelescope for the examination of fractures. It works at a distance of from one to three feet and gives magnifications varying from 25 to 75 dias.

The stand will be in charge of Mr. J. D. Jacobs, one of the partners, who will give demonstrations of microscope work and show magnifications ranging from 50 to 7,500 dias.

Fry's (London), Limited.

This firm, whose head office is at 46, Upper Thames Street, London, E.C.4, are showing hack-saw blades, reamers, and other small tools. A speciality is being made of a hack-saw blade which cuts to and fro, as it is provided with teeth arranged in sets of four passing in opposite directions, thus giving a sharp cutting action in the forward as well as the backward stroke.

Another useful machine which is being shown is the "Eclipse" tool grinder. This takes wheels up to 10 in. × 1¾ in., and occupies only 6 in. × 4½ in. of bench space.

It is pleasing that at last one small-tool manufacturer has realised that the foundries offer a considerable field for their manufactures.

William Allday & Company, Limited.

This firm, whose head office is at 38a, Paradise Street, Birmingham, are showing belt and motor driven fans for cupolas, forges, etc. Perhaps the most interesting exhibit is an oil-fuel burner for mould-drying, core baking and heat treatment of alloys. All exhibits dealing with grinding should be carefully scrutinised by foundrymen in view of the proposed Home Office Regulations. This firm show a new pattern emery grinder fixed with an exhausting fan running on ball bearings. Mr. P. W. Allday will be in charge of the stand.

Chas. Hearson & Company, Limited.

This house, which specialises in metallographic apparatus, has its factory and show-rooms at 68, Willow Walk, London, S.E.1. Their principal exhibit consists of a modern metallurgical microscope EM/1, which is of the Le Chatelier type, and shows the following special advantages.

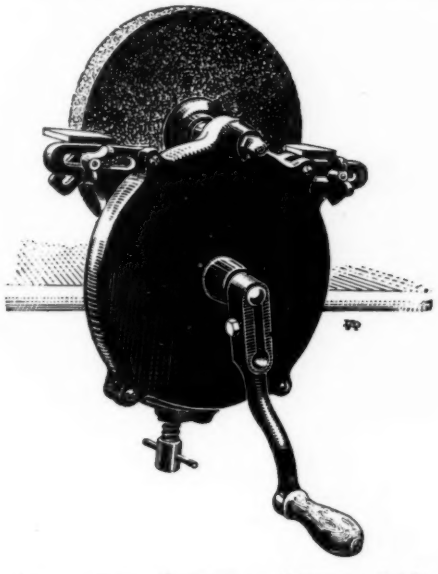
The apparatus is well adapted for use in works owing to the very convenient arrangement of its parts, which enables work to be carried on rapidly and without delays. The following points may be specially noted:—

(1) The entire outfit is supported on powerful springs to avoid vibrations caused by machines in action.

(2) The very practical arrangement of the object stage. The object, which may have almost any size, is put on the stage with its surface to be examined. This position ensures also the right orientation.

(3) Independence of coarse and fine adjustment.

(4) New interchangeable illuminating apparatus by means of which the object under the lowest as well as under the highest magnifications can be illuminated by interposition of either a prism (oblique



SMALL TOOL GRINDER. MESSRS. FRY'S (LONDON), LIMITED.

illumination) or a plane glass plate (vertical illumination), according to the form of illumination that better suits the purpose.

(5) Instantaneous transition from direct visual observation to photographic fixation.

(6) Mirror device for the control of the ground-glass screen.

(7) Separate accommodation of the auxiliary appliances for the macrophotographic apparatus on a small prismatic rail attached to the side of the large optical bench. These appliances are always in position for use, on the rail, and can at any moment be brought into operation in place of the microscope.

Other interesting exhibits are binocular stereoscopic microscopes, workshop microscopes, Brinell measuring microscopes, opaque illuminators with built-in source of light, and appliances for photomicrography.

A novel exhibit is an electric drying oven fitted with new wide-range thermostat registering temperatures from 100 to 300 deg. C. The form of this thermostat provides great rigidity and extreme sensibility, thus allowing the maintenance of temperature within small limits on the above temperature gauge.

The Pneulec Machine Company, Limited.

The works of this concern are situated at Mafeking Road, Smethwick, near Birmingham. Their exhibit, which is a very comprehensive one, includes a large number of modern specialities. Two types of moulding machines are shown, one being an electric jar ram machine and the other a hand-squeezer machine. The advantage claimed for the former is that it is self-contained and merely requires a 5-h.p. electric motor for actuating. A special feature is that by adjusting a thumbscrew the intensity of the bump is varied, which assures the same intensity of ramming from day to day on the same mould. The upkeep is stated to be low, taking but 0.5 of a unit per hour with a 8-cwt. load. The pattern is withdrawn mechanically. The tamper machine takes boxes up to 6 in. deep. It is designed on the squeezer method with the presser plate counterbalanced.

An oil sand mixer is included in the exhibit. It has two parallel worms running in opposite directions and is automatically emptied. It is shown in two sizes having capacities of 170 and 45 lbs. respectively.

Portable riddles are rapidly being adopted by modern foundries, and the one shown by this company represents recent practice. The riddle exhibited is electrically driven from a ½-h.p. motor taking current from the nearest wall plug. All the working parts are enclosed in an oil-tight chamber, whilst an additional cover is fitted for general protection. An ordinary riddle is used.

Swing grinders have long been used in the Sheffield tool steel trades, but their adoption in foundries has not been large. This is difficult to realise, but it may be due to the extra space they take up. The machine exhibited, however, overcomes this difficulty, as it has been made portable and in two types, the one being slung from the crane and the other mounted on a portable trolley.

In addition to the above, the exhibit includes jolt-ramming, hand-ramming, and roll-over moulding machines, core stoves, and various sundries. Core-making is being carried out on the stand, using the firm's specialities known as Pneucol, Lectol, Ventol, etc. Messrs. Pritchard and Ayres will be in attendance at the stand.

The Blackfriars Foundry Requisite and Equipment Company.

The Blackfriars Foundry Requisite & Equipment Company, whose offices are at 181, Queen Victoria Street, London, E.C.4, are exhibiting a representative selection of all foundry requisites and materials.

A special exhibit is being made of their "Esteeler" pressed steel moulding boxes, which are entirely British made throughout. These boxes are made in two distinct section-channel and are, and are such that they give that rigidity and strength required with moulding boxes—the sections are such that they do not "warp" or "spring." These boxes are all machined on both face and back—all are drilled to jig, thus each part is interchangeable. They are particularly suitable for moulding machines. Combining strength, rigidity and accuracy, yet they are light to handle, thus eliminating that undue fatigue which is the case when using the heavy and clumsy cast-iron boxes.

They are also exhibiting backing plates, in mild steel, to take the place of oak boards; also all metal screws to take the place of the usual wooden screws used in non-ferrous. The advantage is that being "all metal" they do not burn, as the molten metal will not hurt them. Another speciality is a silica ganister which is rapidly finding favour in many of the leading foundries.

The Fordath Engineering Company, Limited, Hamblet Works, West Bromwich.

This well-known house, whose factory is at Hamblet Works, West Bromwich, have a representative collection of cores, illustrating the use of "Glyso" specialities. They also show two types of mixing machinery for the purpose of mixing sand and core compounds, and a rotary core machine. These machines are all actually working, so as to illustrate practically their possibilities. Practical demonstrations are given at intervals by the firm's own coremakers. The following representatives are in attendance at the stand:—Messrs. W. M. Wilson (Scotland), T. C. Carlin (North of England), A. H. Newsum (Midland Area), Van Someren (London Area) and Gibbon (South Wales Area), whilst Messrs. T. C. Carlin and Van Someren act as interpreters for foreign visitors.

XUM

T. J. Priestman, Limited.

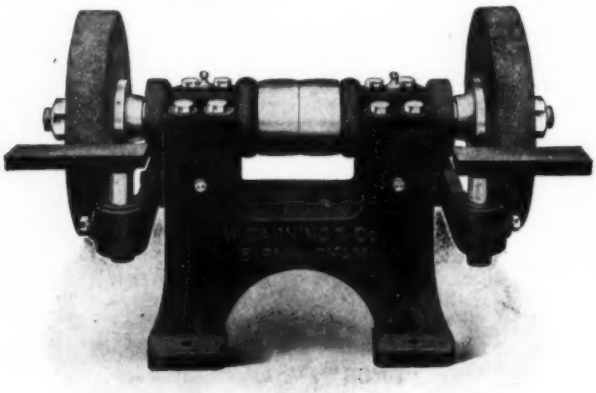
This firm, whose headquarters are at Cupio Foundry, Leopold Street, Birmingham, are showing samples of the alloys they make for non-ferrous foundries. Brass, gunmetal, white metal, phosphor bronze and nickel silver are shown in ingot form suitable for remelting. The principal exhibit, however, relates to aluminium which is shown suitably alloyed for the manufacture of sand castings, die castings, crank cases, pistons and aircraft alloys. Another specialty of this house is the supply of copper, nickel, brass and zinc anodes. Whilst the exhibit is mainly for non-ferrous foundrymen, those interested in steel manufacture and brass sections are catered for by the exhibits of aluminium sticks and brass billets for forging and extension. The object of this house is to cater for foundries by the supply of alloys of definite composition. This has been accomplished by the installation of a modern metallurgical laboratory under the control of qualified chemists. The stand is in charge of Messrs. Alfred Evans and Walter Dowsett, the Midlands and London representatives.

W. Canning & Company, Limited.

W. Canning & Company, Limited, 133, Great Hampton Street, Birmingham, have an interesting stand, where they are showing a comprehensive range of machinery and materials which, with the single exception of their well-known "Reliance" foundry parting, are used in processes for finishing the castings after they come from the foundry. This exhibit is to further the idea that an article well finished is half sold.

For grinding and glazing there is a complete equipment of lathes and wheels for use in all branches of the foundry trade, and the Endurance compressed canvas and leather wheels are an important feature of this exhibit.

There is a complete range of the Canning "Reliance" renewable wire wheels, which are a necessity for expeditiously cleaning castings, metal patterns, removing scale, etc.



DOUBLE GRINDING MACHINE. MESSRS. CANNING & COMPANY.

For purely foundry work the only exhibit is "Canning's Reliance foundry parting," and was introduced to the trade for the first time at the last foundry exhibition. The special merits of this parting powder have become to be very generally recognised from its water-proof quality; the fine skin it gives to the work, and the clearness with which intricate moulding details are brought out. Samples of "Reliance" foundry parting for free trial may still be had, and its merits are worth investigation.

The stand will be in charge of Mr. Lewis and Mr. Zeller.

John M. Terry & Company.

The Denbigh "It's It" patent hand jolt ram moulding machines, exhibited by John M. Terry and Company, of 5, 6 and 7, Great Hampton Street, Birmingham (Patentees and Manufacturers. The Denbigh Engineering Company, Limited, Tipton). These machines were put on the market about 18 months ago and when shown for the first time at the British Industries Fair, 1923, they created considerable comment in the foundry world. The manufacturers since this date have made vast improvements on their machines, and present users will be interested to see the new models, which now include turnover types. The jolt has been improved and moulds can be rammed

THE NEW DESIGN OF "IT'S IT" MOULDING MACHINE. MESSRS. JOHN M. TERRY & COMPANY.

sufficiently hard for steel as easily as for iron, brass or aluminium.

These hand jolt ram machines, being entirely hand-operated, dispense with power plant of any description, the cost of maintenance being therefore nil. One of the many points in favour of these machines is that no loss of output is caused as in the case of power machines when the power unit is out of order, as is often the case.

The output of these hand jolters is similar to that of any mechanically operated machine, and a perfect jolt and draw are obtained, the jolting and stripping of the moulds taking only seconds.

Simplicity is another feature, one lever operating both the ramming and pattern drawing, which makes the machines as near fool-proof as possible. Boxes of various shapes and sizes can be worked on a single machine by a quick and simple adjustment of the lifting pins. Special care has been taken in the design of the machine to eliminate the risk of sand getting into the working parts.

It is possible to jolt a ton easily by hand, because the machine is provided with an oil compensation device which can be quickly adjusted to enable any given weight to be balanced, so that it can be jolted with a very minimum amount of exertion.

A new departure, as far as moulding machines are concerned, is that mechanical power is entirely absent, the working even of the one-ton machine being effected simply by the depression of a lever by hand. This characteristic alone is sufficient to excite more than the ordinary interest, but the fact that no foundation (up to a 10 cwt. job) whatever are required and that the machine can be moved to any selected position and is ready for operation at once makes it unique.

The Avebene Company, Limited.

Of French origin, this firm has recently established itself as a British company at 56, Mosley Street, Manchester. It is showing a number of cores made with Avebene, a core compound which carries a high reputation in Continental Europe. The cores shown have all been made by the company's customers, and include automobile, cycle, radiator, cocks, valves, etc. The compound is stated to be equally suitable for non-ferrous and steel castings.

(*Continued on page* 525.)

THE INSTITUTE OF BRITISH FOUNDRYMEN.

ANNUAL CONFERENCE AT NEWCASTLE.

THE BANQUET.

The annual banquet was held at the Grand Assembly Rooms, Barras Bridge, Newcastle-on-Tyne, on June 4, the President in the chair.

The toasts of "The King" and "The Prince of Wales and Royal Family" were proposed by the President, and were duly honoured.

MR. OLIVER STUBBS announced the receipt of messages of congratulation from the American Foundrymen's Association and the Dutch Foundrymen's Association; also, there were messages of regret for non-attendance from Sir William Noble, Mr. Summers Hunter and Mr. H. Hunter.

Municipalisation or Private Enterprise.

MR. V. C. FAULKNER (Vice-President) proposed the toast of "The City and County of Newcastle-upon-Tyne." He had had no time, he said, to go into the subject of his toast, but the guests were fortunate in that Mr. A. E. Johnstone, of "The Newcastle Chronicle," had given a description of Newcastle and the Tyneside industries in the souvenir booklet. Mr. Johnstone, a brother scribe, had been working in a larger sphere than himself, and was able to deal more adequately with the subject than perhaps any technical journalist could possibly do.

One would have imagined that, having lived on Tyneside for two years, as he had done, he would be able to give some real information about Newcastle, but two years was too short a period to learn of the many vicissitudes and activities of such a large city as Newcastle.

Mr. Johnstone in his article had said nothing of the municipal aspect. The municipality of Newcastle realised that it was advisable to leave to individuals the conduct of communal organisation, such as electricity and gas supply. He reminded his hearers that the cheapest gas in the kingdom in pre-war days, which must still be considered as normal, was supplied by the Sheffield Gas Company, and the cheapest electricity in Great Britain before the war was supplied by the Newcastle Electric Supply Company. Probably Newcastle was right, therefore, in leaving such services to private enterprise.

Again, Mr. Johnstone had not dealt with the diversity of industries which were carried on in the neighbourhood of Newcastle. In this respect the city largely resembled the foundry industry, because in the foundry industry they made anything from a sash-weight to a turbine casing, and they represented every trade operating in Great Britain. So, too, in Newcastle they operated the shipbuilding, the chemical, glass and pottery and other industries, and this phase might usefully be dwelt upon by any person to whom was confided the toast of Newcastle-upon-Tyne.

With the toast MR. Faulkner associated the name of Dr. R. W. Simpson, the Deputy Lord Mayor, who had so kindly welcomed the members that morning. Newcastle contained about 333,000 inhabitants, but had made a finer show than many cities which could claim double the number. Dr. Simpson was chairman of the Health Committee, a very important position to occupy, and one which must take up a tremendous amount of his time and thought.

Finally, he said that as a result of this meeting he was sure that the story of Newcastle, with its wonderful enterprises and its works, would be talked about from Cleveland to St. Etienne.

The Problem of Local Government.

DR. R. W. SIMPSON (Deputy Lord Mayor), in response, explained the regrettable absence of the Lord Mayor, who had had to attend an important meeting concerned with his industry in London. The Lord Mayor had asked him to express his sincere regrets and apologies for his absence.

Dealing with the problem of local administration, he said this was becoming very complicated, and emphasised to those present, who came from all over the country, that local government was becoming a very important business, and called for the very best brains. In local government they were trying to make intelligible and effective those half-digested Acts of Parliament which were dumped down on the local authorities, who were invited to administer them to the best of their ability. Therefore he made an appeal to all who took a responsible view of their position in this world that it was their job to come forward—the very best of them—and help in solving this very difficult problem.

In expressing the enjoyment which his association with the foundrymen had given him, he said he had always associated foundrymen with Falkirk —(laughter)—but understood that there were quite a lot of foundrymen who had never seen Falkirk. There were two kinds of foundrymen, namely, real foundrymen and gentlemen who went in for light castings. He was almost ashamed to admit that he had been associated almost entirely with the latter. However, in future he would take a good deal more notice of the other man. He had been very struck with the high ideals of the Institute. He liked its motto, namely, the linking up of science with industry. If they could get that spirit to spread throughout the country—the linking up of the workman with the thinker, with the result that both were pulling at one end of the rope instead of opposite ends—then they would begin to see hope for the country. He considered that the British working man was the finest man in the world, and if he co-operated with the administrator, the thinker, and the scientist, the result would be that we should not have to worry much longer about the condition of Europe.

Meeting Competition by Research.

SIR THEODORE MORISON, K.C.S.I., K.C.I.E., then proposed the toast of the "Trade and Industries of the North-East Coast," and associated it with the honoured name of Lord Joicey, whom all at Newcastle-on-Tyne had so long respected and admired. When Lord Joicey that morning had welcomed the Institute, in the name of the Chamber of Commerce, he had taken occasion to point out that British industry was going to be faced with competition in the future such as it had never had to meet before, and he (Sir Theodore) would venture to corroborate that, from what he had seen in India and in Asia, because he could assure his hearers that the industrial arts which had first made England the workshop of the world were easily learned by the intelligent people of Asia. Therefore he realised to the full the truth of what Lord Joicey had said, and how these people, who had hitherto been our customers, would in future make for themselves the goods which they had been previously in the habit of buying from England. But Lord Joicey had continued that we could only meet this serious competition by more intelligent workmanship and by associating the industries of England more closely with the advance of science. He was sure the Institute would bear the advice of Lord Joicey in mind. If he himself might speak of it from the University end, he would say that he thought the association of industry with science was going to be of distinct benefit to science as well as to industry. He hoped the Institute would always take a wide view of science and would not consider merely the direct and commercial application of it, but would realise that it was pure science which was material and which had in the past proved to be of the greatest utility to mankind. Researches which were pursued only for the sake of expanding the bounds of knowledge, and for the sake of truth alone, had in the course of time proved to be useful to the very highest degree. There was a time, for instance, when entomology was spoken of with a sort of laugh, as the most useless of the sciences, and the caricaturist who wished to make cheap fun of science found nothing easier than to draw a picture of a spectacled man of science rushing over the country with a butterfly net. That was

supposed to be typical of the futility of pure science. Now, however, it is common knowledge that a great many of the diseases from which mankind had suffered most were insect-born diseases, and a knowledge of entomology had proved the means of meeting such terrible maladies as malaria, plague, sleepy sickness, yellow fever and many others. Even a knowledge of entomology is now possessed by many laymen.

Sir Theodore then referred to the solution of many industriai problems which had been investigated by Pasteur as the result of his scientific researches, and said he was convinced that it was in the fruitful association of industry and science that both industry and science would get the best reward.

The toast was received with acclamation.

Science in Industry.

THE RIGHT HONOURABLE LORD JOICEY, responding, said that all industries, in whatever part of the country—he might almost say the world—were pretty much in the same position as the result of the Great War. Therefore, when he spoke of this toast he felt he was speaking upon a subject which was of vital interest to all present, and to all those throughout the country who were connected with the important industries which were carried on. In thanking Sir Theodore Morison for the kind manner in which he had proposed the toast, he said he was very glad indeed to find that Sir Theodore was at the head of the University at Newcastle, to which they owed so much, and to which they were looking for so much in the future. In these days science plays an important part in our industries; in fact, science was going to rule the world. In the war we had fought the enemies successfully by science; in peaceful occupations we used science. Our ships were the best ships in the world owing to the science displayed in their construction and navigation. It was the same with our industries. If we were anxious to maintain the great reputation which this country had had in the world in the past, depend upon it we should have to make use of science to the very greatest extent we could. We had had great competition to meet. Germany was our great competitor. Why? It was not that the working men of Germany were more skilful or better workers than ours, or that the men who controlled these industries were more clever. The real reason was that the Germans applied science more to their various industries, with the result that they were able to produce cheaper goods, and to supply the world and districts where we had been accustomed to be practically predominant.

Strikes and Industry.

Again, we were suffering from the chaotic condition of the world's exchanges, and it was a very difficult matter to see how we were going to alter that. Governments were trying to alter it, but so far had not met with very much success. Again, there were strikes in every industry, all over the country. Surely it was the duty of the Government, if any duty it had, to try to introduce some method of avoiding these strikes. We did not want to adopt the methods of Mussolini. He had seen it stated that the year before Signor Mussolini had taken command of the Italian Government there were between seven and eight million days' work lost by strikes. The first year in which he had taken command there were something under 250,000. Surely, if Signor Mussolini could do that, it should not be beyond the power of our Government to do it, particularly a Labour Government, who pretended to understand these matters better than the leaders of industry.

Sir Theodore Morison had spoken about microbes. He (Lord Joicey) could not help thinking that, if there were a microbe affecting nearly all classes to-day, he would call it a microbe of slackness, and, if anybody could adopt a means to get rid of that unfortunate microbe, we should see a very great change indeed in the industrial position of this country. As an illustration of the effect of slackness, he referred to the inability to solve the housing problem, and made an appeal to the trade unions in this connection. He believed that there was no one more responsible at the present time for the shortage of houses than the building operatives themselves.

In conclusion, his Lordship expressed the hope that the prospect might be better than he anticipated. He was not a pessimist by any means, but a natural optimist, but when he saw facts before him he had always been accustomed to judge from those facts.

Photo.] [*Newcastle Illustrated Chronicle.*

GROUP OF OFFICERS AND PRINCIPAL GUESTS AT THE NEWCASTLE CONFERENCE.

The Work of the Institute.

DR. J. T. DUNN then proposed the toast of "The Institute of British Foundrymen," in the absence of Mr. Summers Hunter, C.B.E., J.P., who was to have proposed it, but had been detained in London on important business.

Dr. Dunn said he did not know what qualifications he possessed for proposing the toast, other than the very essential one of not being a member of the Institute, and, if he showed no others, he could only crave the indulgence of his hearers for his failure to perform adequately a duty so suddenly imposed upon him. He knew little of the Institute, but, from the little he did know, it seemed to be, in one respect at least, unique among our technical and scientific societies. For long the reproach had been heard of British industry that it was not conducted on scientific principles, but that it depended upon rule-of-thumb. There could be no question that an industry, to be thoroughly successful, ought to be,

and must be, conducted upon scientific principles. Science must play its part, and we must, in order to perform the necessary operations successfully, understand the why and the wherefore of them. But, whilst that was the case, possibly the rule-of-thumb had been a little under-rated. In every industry, many of the workmen who had to conduct the manual operations were destitute of any scientific knowledge of the problems which underlay that industry. But, at the same time, though they worked by rule-of-thumb, they had a technical knowledge and deftness of manipulation which was possessed by no one else. That was perhaps the case to a varying extent, according to the age of the industry. The foundry industry was a very ancient one. It dated back at least to the days of Tubal Cain, and if in one industry more than in others they had accumulated, under the rule-of-thumb, an amount of tradition and an amount of experience, which was transmitted through the workmen, to a greater extent than in many other industries, it was in the foundrymen's industry. It would be a foolish thing, in endeavouring to apply scientific principles to the industry, to neglect or to throw on one side all that vast mass of accumulated experience and detailed knowledge, and what appeared to be the this toast proposed in better form. Dr. Dunn had referred to the value of science in the industry, and he (the President) thought that they, as an Institute, could boast of having instituted science in their foundries and thereby having gained enormous benefit to the industry. They were primarily responsible for the formation of the British Cast Iron Research Association. Many of them knew all about it, but some may not know that in this country there is an Association entirely for the purpose of carrying out researches into the very complex question of cast iron and other foundry problems.

They had with them that evening Mr. Pearce, Director of the British Cast Iron Research Association, and it was with great pleasure that he extended to him a warm welcome. Mr. Pearce is doing valuable work for the industry, and he (the President) had no doubt that within a very few years they would be in a better position in this respect than they are to-day. They also had the hearty interest of such men as Professor Turner; indeed, they had had a paper by one of his pupils. Professor Turner has done immense work upon cast iron, and his books and papers are unique and very valuable. They also had with them representatives from America, France and Holland. This, natur-

Photo] [*Newcastle Illustrated Chronicle.*

GROUP OF LADY VISITORS TO THE NEWCASTLE CONVENTION.

distinguishing feature of the Institute of British Foundrymen was that it did not neglect that, but that it had endeavoured, through its membership, to include the whole. The membership consisted not only of the controllers and guiding spirits of the industry; not only of the chemists who supervised the work and had an insight into the principles underlying the whole of it; not only the foremen, who supervised the operations of the foundry; but also the working men—those who actually performed the manual operations. That showed that the Institute of British Foundrymen had taken the very best course to ensure that foundry work in the future should be founded upon scientific principles, and should prosper and succeed. The very wise King Solomon had said: "Happy is the man that findeth wisdom and the man that getteth understanding, for the merchandise of it is better than the merchandise of silver, and the gain thereof than fine gold."

It seemed that the Institute of British Foundrymen had found wisdom, and had endeavoured to get an understanding of all the principles which underlay its work; surely they might wish it God-speed in its efforts.

American Foundry Conditions.

THE PRESIDENT, who, when rising to respond, was greeted with loud cheers, said he had seldom heard ally, went to show the strides that had been made by the Institute. He thought he was right in saying that theirs was the first Foundrymen's Institution in the world, and that other countries had copied, and are still copying, their example. On the other hand, speaking of the practical work, apart from science, he thought they were to be congratulated upon the class of workmen they had in Great Britain. Lord Joicey had certainly given them something to think about, but he (the President) had great hopes and great faith in our men, and thought that they were undoubtedly the most highly skilled men, without exception. He had paid a visit to the States some years ago, and was greatly struck by the fact that the workmen there who were doing the intricate class of work in the foundries were Britishers, but he must admit that a large percentage of them were Scotsmen. (Laughter.)

At the same time, he would say that our American friends stood predominant as regards repetition work, but, to be fair again, he thought they had been driven into that position because they had not the highly skilled men available there. They had had to make their castings by machinery because of their lack of skilled labour.

Mention had been made of the wide range of the output of foundries in this country. At his own firm they made castings ranging from sash-weights

to turbines, and he thought that on Tyneside the workmen were as highly skilled, and turned out as high a class of work as any others in this country.

Education Facilities not Available.

Education had been touched upon, and they, as an Institute, were greatly concerned about the education of the younger men in the foundry. They would like some sort of classes to be inaugurated for the education of those boys. A year or two ago the Newcastle Branch approached the Education Authorities of Newcastle to see if some sort of popular lectures might be arranged for the benefit of those boys, and to give them interest in the elementary science of the business. They received the answer: "Yes, we can do that, but, of course, the boys will have to matriculate before they can do anything." He (the President) would like to know how many of those present that evening could go through a matriculation examination. He therefore thought that it would devolve upon themselves to institute classes to suit their own men.

Inadequate Engineering Support.

For many years the foundry industry had been the Cinderella of all the engineering trades. They had never had an adequate price for their products, and the result had been, and still is, that they were hard up. They simply could not afford any money to conduct researches. There were thousands of foundries which ought to have laboratories, but could not afford them. There are about three thousand foundries in this country, and how many of them had not joined the British Cast Iron Research Association because they could not afford it? He thought that this was a very deplorable state of affairs. Cast iron was a very complex material, and we really could not do without metallurgists, but we really could not afford them. Therefore, we should have to have better prices from our engineers. The Institute of British Foundrymen was very dear to him, and it had helped the industry immensely.

In conclusion, he wished to say that he was very much indebted to Dr. Dunn for the very able way in which he had proposed the toast, and, on behalf of the members, he wished to thank him.

The Guests.

MR. OLIVER STUBBS, Past-President, proposed the toast of "Our Guests," and said how very much the Institute appreciated their presence. The Institute had never had such a splendid gathering as they had on that occasion, and he was delighted to see all the guests. The Institute claimed that it was entitled to the presence of the guests, because it had been working very hard for a long time with very poor recognition from the heads of industry. The work it was doing was of a most important nature. He claimed that if we took the working classes of this country and got the thinking classes to talk to them and educate them, they would give of their best. It was entirely the fault of the thinking classes if they allowed other people to take the workers in hand, and he asked the guests, particularly those interested in the engineering industry, that they would give the Institute in the future very much greater support than they had done in the past.

Among the many guests present he mentioned Lord Joicey, the Rev. Canon G. E. Newsom (Vicar of Newcastle), and Sir Archibald Ross. In regard to the latter, he said that, from his experience of Sir Archibald, the Institute had in him a very excellent character, and one which many of them might endeavour, as far as possible, to copy. It had been his privilege on many occasions to listen to Sir Archibald Ross when matters of extreme importance had been under discussion, and he had never found that in any case had he taken anything but an impartial view, and had always endeavoured to give the very best judgment.

On behalf of the Institute, he again expressed thanks to the guests for their presence, and complimented the Newcastle Branch upon the fact that they had been able to assemble so many important guests. He coupled with the toast the name of Sir Archibald Ross.

British Power Producing Plants.

SIR ARCHIBALD ROSS, responding, said he liked to think that the reason he was asked to respond to the toast was because he was President of the North-East Coast Institution of Engineers and Shipbuilders. One might say, "What are all these Institutes doing, with banquets, beanos, speeches, etc.?" He, himself, was aware of the work which the Institute of British Foundrymen was doing on the technical side of the profession, and too much stress could not be laid upon that. Lord Joicey had said that it was not owing to the superiority of her workmen that Germany was forging ahead before she had made the great mistake of her history, but that it was because of superior technical knowledge. Though he agreed with Lord Joicey as to the wickedness and idiocy of restriction of output, he would not admit that we were lacking in technical education, but he did say that, at the present time, more than ever before, is it necessary to advance education because of the great advances that are being made in the engineering industry; and it was because of the crying necessity for economy that we had to seek for better results and higher efficiencies in all power-producing plants. Because of that, we had to have recourse to superheat, to the better use of oil and—although Lord Joicey might regret it—to the less use of coal, and it was because of these advances which were being made, which were to result in getting more power for less fuel, that the engineering industry had to look to the moulder to give it more complicated castings than in the past. The President had said that engineers did not pay an adequate price for castings. He (Sir Archibald) would say that engineers did not get an adequate price for engines either.

In conclusion, he expressed the thanks of the guests for the hospitality extended to them.

The Chairman.

MR. WESLEY LAMBERT proposed the final toast of the evening, that of "The Chairman," which, he said, he proposed with a very great deal of pleasure. On behalf of the General Council, of which he was a member, he could say they had no misgivings at all that the President this year would see them through his year of office with every credit to himself and to the Institute. He (Mr. Lambert) had no fear at all that there were any difficulties which the President would not plough through. Therefore, he had great pleasure in proposing the toast of the President of the Institute.

The toast was received with musical honours.

THE PRESIDENT, in a brief response, thanked the assembly for the way in which the toast was received, and took the opportunity of expressing thanks to the Convention Committee for the way in which the banquet had been carried out. In particular, he mentioned Mr. Colin Gresty (Secretary of the Convention Committee)—(applause)—upon whose shoulders the bulk of the work had fallen. Indeed, he had worked like a nigger, with the results which were so apparent. Mr. Gresty had taken all the work from his (the President's) shoulders.

An excellent musical programme was rendered during the evening, and the banquet ended by the singing of "Auld Lang Syne" and "The National Anthem."

SECOND DAY.

On Thursday morning the conference was continued in the Lecture Theatre of the Literary and Philosophical Society. The President occupied the chair. After the discussion on Mr. A. Logan's Paper on "Non-Ferrous Alloys in Marine Engineering,"

THE PRESIDENT announced the receipt of a letter of congratulations from the President of the Italian Foundry Association.

An American Appreciation.

MR. H. D. MILES, of Buffalo, U.S.A. (Past-President of the American Foundrymen's Association), who was present, then addressed the meeting, on the invitation of the President. When it was known that he was coming to this country, he said, the Secretary of the American Foundrymen's Association had asked him to attend the Convention, and he had been very glad to do so. Speaking of the visit of the American foundrymen to this country last year, he said that all those who had come over had expressed their very great pleasure at the way in which they were treated, and the interesting things they had seen. Mr.

Miles then read the text of an illuminated address, which had been prepared and signed by the President and Secretary of the American Foundrymen's Association, and was to be presented to the Institute of British Foundrymen. It was as follows:—

"To the Council and Members of the Institute of British Foundrymen: Mr. Oliver Stubbs, its President; Mr. R. O. Patterson, its Senior Vice-President; Mr. E. H. Broughall, its Junior Vice-President; and Mr. W. G. Hollinworth, its Secretary. We, the Board of Directors of the American Foundrymen's Association, at our first meeting after the visit of our officers and certain of our members to your shores, on the occasion of the International Congress of Foundrymen, held at Paris, September 12 to 15, 1923, have, by unanimous acclaim, directed that this testimonial be transmitted to you. Verbal expressions, by those of us who enjoyed your generous hospitality and delightful comradeship, have been made.

"To those individual expressions we would add our sincere and heartfelt collective appreciation. To the joy of personal friendships formed, the happiness engendered by innumerable attentions and distinguishing entertainment, was added the sense of kinship and consonance of purpose. It was an inspiration to fraternise with those who think strongly, attempt fearlessly, and accomplish masterfully with magnanimity. Allied by blood, speech and similar ideals, may we embrace every opportunity to pool our pleasures as well as the problems that beset our calling, that difficulties may be bravely met and wisely overcome. May mutual esteem and purpose, seasonably planted, bloom and bring forth fruit.

"We ask that you accept this official expression as the composite of many, with wishes of happiness and prosperity to each of you, to your Institute, and to your great nation.

"THE AMERICAN FOUNDRYMEN'S ASSOCIATION."

Continuing, Mr. Miles said he was glad to be able to present the text of the address at that meeting, when so many members of the British foundry industry were assembled together. Referring to the forthcoming convention of the American Foundrymen's Association, on October 15 next, he said there were always a number of exhibits at those conventions, and they were showing a large number of machines which were manufactured in the United States for use in the foundry industry. This combination of papers and exhibits brought a large attendance, there being usually an attendance in the neighbourhood of 3,000. There were a good many Papers, but not very much discussion upon them, but the attendance was greatly enhanced by reason of the exhibits. The latter were under the direct management of the Association, and, by that means, they were able to get a good deal of revenue, which helped along the educational work of the organisation. In conclusion, Mr. Miles again expressed his pleasure at being able to attend the Convention at Newcastle.

International Co-operation.

MR. OLIVER STUBBS, responding, said it was a very gratifying finish to his presidency of the Institute of British Foundrymen to hear from Mr. Miles the testimonial, a copy of which, he understood, was being forwarded by the American Foundrymen's Association to each of those branches of the Institute who had entertained the members of that Association during their visit to England last year. But, if he might be perhaps a little impertinent he would like to say that other branches, though they had not had the opportunity of entertaining the Americans, were none the less loyal in their kind regard towards them, and he would be glad if the American Foundrymen's Association would be so good as to send a copy of the testimonial to each branch of the Institute. Great strides were being made on the international aspect of the foundry industry, and they all knew full well that it was this interchange of opinion that was going to bring the nations still more closely together. We had been concerned often with regard to the question of another big war; but he would say, as he had said in the past, that if the people in the different countries, connected with industry, were allowed to get together and to discuss the matters which concerned their industries we should not be talking about wars.

On behalf of the Institute, Mr. Stubbs welcomed Mr. Miles, who occupied a prominent position in the engineering world in the States, and, he believed, as far as the States were concerned, was very much to be thanked for the high pressure of blast at which they were bringing their metal down in their cupolas. The closer the alliance between the English-speaking nations, the sooner should we get to understand each other better, and reach the position of giving everybody credit for good intentions.

Mr. Stubbs then referred to a member of the Institute of whom they thought a great deal, and who was returning, in September, to his homeland—America. That was Mr. H. Cole Estep. Mr. Estep, he said, had been largely responsible for bringing about this good feeling between the U.S.A. and Great Britain, and the Institute felt that his going away would be a great loss to them. (Hear, hear.) They hoped he would come back pretty often. In fact, he was coming back in 1926, in which year he would be taking about 300 members of the Institute of British Foundrymen over to the States to attend the International Conference there. The members of the Institute had valued Mr. Cole Estep's presence in this country very much indeed. The high ideals and high principles he had expressed had been a great incentive to them, and if the American foundry industry sent someone half as good to take his place, then the industry in Great Britain would be fairly lucky. Finally, Mr. Stubbs expressed the hope that Mr. Cole Estep's future would be crowned with prosperity.

MR. H. COLE ESTEP expressed his deep appreciation of the remarks to which Mr. Stubbs had given expression, and regretted his inability to deal with them adequately at a moment's notice. But it was well known that he had felt very much at home in this country, and in a good many ways he was very sorry indeed to be going back. Americans who came to this country were to be congratulated upon their good fortune, and he could heartily second everything that Mr. Stubbs had said with reference to the usefulness of a mutual understanding between the two nations.

Convention Committee Thanked.

After the various Papers had been discussed, COLONEL W. F. CHEESEWRIGHT, D.S.O., rose to propose a hearty vote of thanks to the President and the Convention Committee, and took the opportunity of endorsing the remarks made earlier by Mr. Stubbs in regard to Mr. Cole Estep, and said that, in the course of something like thirty years of journalism, he had seldom, if ever, met a man who combined such a charming personality with such efficiency as did Mr. Cole Estep. Therefore, it gave him very great pleasure, as a brother journalist, to add those few remarks regarding his friend.

Colonel Cheesewright then proposed that the heartiest thanks be given to the President, and to the Committee who had worked so well behind him to bring about this record Convention. He was perfectly certain that the President had put in a great deal of very hard work in order to bring about such a successful meeting. Also, he mentioned especially Mr. Colin Gresty (the Hon. Secretary of the Convention Committee), and asked all concerned to accept the heartiest congratulations and thanks of the members.

MR. F. J. COOK seconded the vote of thanks with the greatest cordiality. Speaking of the Papers which had been discussed, he said their quality was very high indeed—so much so that he did not think any conference in any country had ever had a set of Papers to equal them. Another striking feature of the Convention had been the very great desire to discuss the Papers. It was within the memory of some of the members that in the earlier days there was great difficulty in getting members to discuss even Papers on somewhat elementary subjects; now, however, there is a great desire to discuss intelligently even the very highbrow Papers, and that indicated the very great progress they were making as an Institution.

The vote of thanks was carried with enthusiasm.

THE PRESIDENT, responding, disclaimed any credit to himself, because he had done nothing, but he paid a tribute to Mr. Gresty for having shouldered the bulk of the work, and to Mrs.

Gresty, who had rendered valuable assistance. After agreeing with Mr. Cook that the Papers presented had been excellent, and expressing his gratification that the Convention had been successful and enjoyable, he returned thanks on behalf of the Convention Committee.

MR. COLIN GRESTY, who also responded, disagreed with the President that the bulk of the work had fallen upon his own shoulders, though he acknowledged the help that Mrs. Gresty had rendered. Also, he mentioned the names of Mr. E. Wood (Chairman of the Committee), Mr. H. J. Young (Vice-Chairman), Mr. H. F. Parsons (Hon. Treasurer), and Mr. Victor Stobie, all of whom had worked very hard, the last named having, to a large extent, made himself responsible for the catering arrangements. On behalf of the Committee, he said that the greatest thanks they could possibly have was that the members should thoroughly enjoy their visit to Newcastle.

MR. V. C. FAULKNER then put to the meeting an omnibus resolution, expressing the thanks of the Institute to the authors of Papers, especially the foreign contributors; it also included the thanks of the Institute to the Newcastle Literary and Philosophical Society for having placed their lecture theatre at the disposal of the Institute. This MR. R. A. MILES seconded. The resolution was carried with acclamation, and the meeting closed.

Civic Reception and Garden Party.

In the afternoon there was a civic reception and garden party in the Banqueting Hall at Jesmond Dene, by invitation of the Right Honourable the Lord Mayor and the Lady Mayoress of Newcastle (Councillor and Miss Easten) on behalf of the City Council. There was a large number of members and visitors present, and the afternoon was thoroughly enjoyable.

THE LORD MAYOR, in welcoming his guests, apologised for having been unable personally to welcome the Institute on the occasion of the opening of the Convention. He expressed the hope, however, that the visit of the Institute to Tyneside would be both pleasant and profitable.

Both the PRESIDENT and MR. OLIVER STUBBS voiced the thanks of the Institute to the Lord Mayor, Lady Mayoress, the Deputy Lord Mayor, and the Corporation for the kindness and hospitality they had extended to the members.

In the evening the members and ladies attended the Theatre Royal, at the invitation of the Convention Committee. An enjoyable entertainment was provided by "The Co-Optimists."

THIRD DAY.

Friday morning was occupied by the members and ladies in visiting various works in the neighbourhood of Newcastle.

Luncheon.

Later, the members and ladies were entertained to luncheon at the Grand Assembly Rooms, Barras Bridge, by the Convention Committee. The President was in the chair.

COLONEL CHEESEWRIGHT, D.S.O., who, in an amusing speech, proposed the toast of "The Newcastle-on-Tyne Branch," said all would agree with him that the Branch had put up a most wonderful show. The Convention had been such that he ventured to think it would be very difficult for other towns to follow Newcastle's example. He had been very much impressed with the hospitality which had been extended to the Institute by the Newcastle Branch, and, on behalf of the members and ladies, he offered grateful thanks

MR. R. BUCHANAN (Past-President), who supported the toast, said the whole Convention had been wonderful, and it had been a delight to be present. The labour of the Convention Committee and of all those who had contributed to the pleasure of the members of the Institute and the ladies so effectively, must have been a labour of love, and he expressed thanks to Mr. Wood, Mr. Young, Mr. Parsons, Mr. Gresty, and Mr. Stobie in particular, and to the Newcastle Branch in general. The Convention would certainly remain in the memory of those who had attended it as one of the brightest that the Institute had ever had. He coupled the toast with the name of Mr. J. Smith (President of the Newcastle Branch).

MR. JAMES SMITH, responding, referred to the time when the last Convention was held in Newcastle, 18 years ago. At that time, he said, there was no Branch of the Institute in Newcastle, but there were three members of the then Foundrymen's Association on the Tyne, Wear and Tees, namely, the late Mr. McFarlane, the late Mr. William Dalrymple, and himself. He sincerely hoped that he would be present when the next Convention was held in Newcastle. (Hear, hear.) About 12 or 13 years ago the Newcastle Branch of the Institute was founded. They had started with less than 50 members, but had progressed steadily, and there are now fully 250 members on the register. His hearers could rest assured that the Branch would continue to increase its membership, and he had not the slightest doubt but that in a few more years it would be one of the finest Branches in the whole country. After paying a tribute to the Convention Committee, and particularly to the gentlemen named by Mr. Buchanan, he referred to the manner in which the ladies had contributed to the success of the Convention, making special mention of Mrs. Gresty, who had worked so hard for the Convention Committee. In conclusion, he presented a bouquet to Mrs. Gresty, on behalf of the Newcastle Branch, as a mark of appreciation of the valuable services she had rendered.

The presentation was made amid loud applause.

Both Mrs. and Mr. Gresty returned thanks, the latter again drawing attention to the tremendous amount of work done by other members of the Committee.

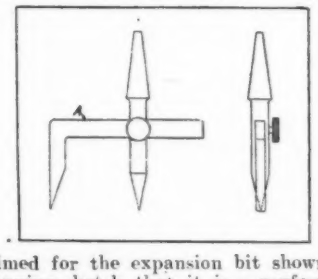
MR. VAN AARST (of Holland) then expressed, on behalf of himself and Mons. P. Chevenard (France), their keen appreciation of the kindness which had been extended to them during the Convention The treatment of them by the British foundrymen would always be remembered by their own countrymen, who always regarded the British as real friends.

MONS. P. CHEVENARD, speaking in French, also returned thanks for his very cordial reception; in the name of the Association Technique de Fonderie de France, and of his countrymen generally, he must say "Merci."

Following the luncheon, the members and ladies split into two parties, one of which drove by motor to Rothbury, at the invitation of the Convention Committee, whilst the other went for a sail down the Tyne, by invitation of the Tyne Improvement Commissioners.

Simple Expansion Bit.

The expansion bit is one of the most useful patternmaking tools, and yet, in the largest shops, only one or two workmen may have one. One reason for this is, no doubt, that they are costly, and another reason may be that, in many shops, a boring machine is installed which can rough-out large diameters or recesses. The essential value of the expansion bit is for boring large dowel-holes. A twist or ogre bit is used up to $\frac{3}{4}$ in. or 1 in. and a centre bit from this to $1\frac{1}{4}$ in. A centre bit is not ideal for dowel-holes because it does not cut very well, but more often tears the wood. It is



not claimed for the expansion bit shown in the accompanying sketch that it is a perfect cutting tool, but it has applications for which the expansion bit is unsuitable. It is only useful for thin work. It is quite common in a patternshop for a large number of thin—$\frac{1}{4}$ in. or so—washers to be required. They may be bandsawn and sandpapered if there is a sanding disc. On the other hand, they can be cut quickly with the tool shown. The tool can be quickly made by a blacksmith, the arm A being subsequently filed a sliding fit in the hole, and the adjustment is by means of a screw with a milled head. It will be found that a taper is made in the washer.—J. E.

The Formation of Graphite in Cast Iron.*

By L. Northcott, M.Sc. (University of Birmingham).

INTRODUCTION.

It has been recognised from the earliest days of the use of cast iron that white iron is hard, while grey iron is relatively soft. For more than a century it has been known that grey cast iron contains carbon in the graphitic state, but it is only in recent years that the effect of the size, shape and distribution of that graphitic carbon upon the mechanical properties of the casting has been recognised. The size and shape of the graphite is dependent upon two main factors, namely, the original composition of the fluid metal, and the rate of solidification and subsequent cooling of the metal. It is well known that ordinary cast iron is a complex aggregation of many substances, chief of which are iron and carbon, with smaller proportions of silicon, sulphur, phosphorus and manganese. Occasionally other elements are encountered in small percentages, such as nickel, chromium, titanium, aluminium, etc. The chief element which is regularly present in cast iron is carbon. It is an essential constituent of all cast irons, since with less than about 2 per cent. carbon the characteristic properties of cast iron are not obtained. The object of this Paper is to consider the occurrence and properties of carbon as it occurs in ordinary cast iron.

It is also a matter of common knowledge that certain kinds of grey iron, if cooled quickly, become hard and brittle, whilst some varieties of white cast iron, if allowed to cool slowly, or when long-annealed, become grey and soft. This change is connected with the fact that the carbon exists in two distinct forms, each of which can be divided into two kinds. In grey iron the carbon exists in its elementary form, *i.e.*, by itself, and is generally known as graphite. This graphite can be separated in a more or less pure form by dissolving a sample of grey iron in acid; the iron dissolves in the acid and the graphite remains.

In white iron, on the other hand, the carbon is combined with iron forming the compound cementite or iron carbide, Fe_3C, the properties of which are entirely different from those of either pure iron or carbon. Whereas pure iron is soft and ductile, cementite is intensely hard and brittle. White cast iron, in fact, may be considered as a high carbon steel containing an excessive amount of cementite, which renders the iron practically useless from the engineering point of view. Fortunately, however, one can change iron carbide into graphite and iron, and back again, by appropriate manipulations of temperature and by suitable additions of what might be called the minor elements of cast iron, such as silicon, sulphur and manganese, each of which elements exercises its own particular influence on the stability of one or the other of the two forms of carbon as found in cast iron. Since white iron as such finds little use in engineering construction, on account of its extreme brittleness, it is proposed to devote but little attention to it in this Paper. It must be kept in mind, however, that there is an important industry which deals with the conversion of the hard and brittle white iron into a soft and malleable material, suitable for commercial use. This phase of the subject is dealt with later.

From the point of view of industrial utility, therefore, foundrymen need a cast iron containing only such small proportions of cementite to impart sufficient hardness and strength to the iron, and the rest of the carbon to be in the graphitic state. Since the actual strength of graphite is very small, in fact negligible when compared to the strength of iron, it is essential that the graphite is in the shape or form in which it will do least harm to the metal. By removing the graphite altogether, and leaving in the iron a small quantity of cementite, giving a carbon content of, say, 1 per cent. or less, we should have, mechanically, a very good material, steel in fact, but the cost would be very much higher than that of the original iron, and cast iron owes its existence largely to its low price.

* A Paper presented to the Newcastle Conference of the Institute of British Foundrymen.

As would be expected, the graphite is most harmful to the iron when it exists in very long flakes, which break up considerably the continuity of the metallic matrix. Assuming that there is a small bar of cast iron subjected to tensile stress, then, taking the extreme case, the graphite would prove of greatest harm when it existed right across the specimen in a direction at right-angles to the length of the bar. Of course, in practice such a case never occurs, but it is easy to visualise how harmful large flakes of graphite can be. That graphite is contributory to fracture is shown in Fig. 1. A small broken piece of grey iron was copper-plated and then sectioned. When polished and examined under the microscope the fracture was observed to be along the graphite flakes. A micrograph of an iron containing large graphite flakes is shown in Fig. 22. Graphite also occurs in another or nodular form, when it is variously called temper-carbon, annealing carbon or secondary graphite. This form of carbon is best seen in good malleable cast iron, particularly the American black heart varieties. A photograph is shown in Fig. 2. On comparing Figs. 22 and 2 it is obvious that the graphite in the former is of the more harmful character.

TABLE I.

Fig.	Temp.	Time hrs.	Micro-Constituents
3	As received	—	Cementite and Pearlite.
4	750°	46	Cementite, Pearlite, and Temper-Carbon.
	750°	106	Similar to No. 4.
5	860°	32	Cementite, Pearlite, and Temper-Carbon.
6	900°	31½	Temper-Carbon.
7	990°	30	Temper-Carbon.
8	1,050°	17½	Graphite, Pearlite, and Ferrite.
9	1,100°	14	Graphite and Ferrite.
10	1,100°	25½	Graphite.
11	1,140°	8	Graphite, Cementite, and Pearlite.
12	1,140°	20	Graphite, Cementite, and Pearlite.
13	1,150°	1	Cementite, Pearlite, and Eutectic.
14	1,150°	3½	Pearlite and Ferrite.
	1,150°	5	Almost all Ferrite.

NOTE.—(1) Figs. 6, 7 and 10 were unetched (2). All samples were heated *in vacuo*, except Figs. 9, 13, 14, and the last sample.

The work described in the present Paper was undertaken in order to examine the process of the formation of graphite in commercial cast irons. The first section deals with the effect of annealing white cast iron at different temperatures and under such conditions as to produce temper-carbon or nodular graphite. Some observations regarding the precipitation of the carbon are made, supplementary to those of Fisher,[1] Hatfield[2] and Charpy and Grenet.[3] The second part of the Paper describes experiments on a typical grey cast iron of good quality to determine the mechanism of the formation of flakey or primary graphite as commonly found in grey irons.

PART I.

THE ANNEALING OF WHITE IRONS TO PRODUCE NODULAR GRAPHITE.

It is the general experience in the manufacture of malleable castings that the lower the annealing temperature, provided that complete annealing is obtained, the better the casting. Further, the annealing temperature has been considered to have some effect on the form of the precipitated carbon. An investigation was therefore carried out to determine exactly what effect different annealing

1. Fisher, Trans. American Foundrymen's Association, 30, 395. See also White and Archer, ibid., 27, 331.
2. Hatfield, "Journal Iron and Steel Institute," 1907, 2, 79.
3. "Engineering," 1902, 73, 626.

temperatures had on the shape of the temper-carbon precipitated during the annealing of white iron. Temper-carbon may be defined as the finely divided graphite found in malleable cast iron, occasionally in heat-treated grey irons, or in badly heat-treated steels.

Experimental Details.

The iron used in these experiments was a typical sample of white iron used in the White Heart, European or Reaumur process of malleable cast iron manufacture, and contained Cc, 2.9; P, 0.04; Si, 0.61; S, 0.38, and Mn, 0.11 per cent. Fig. 3 shows the micro-structure, and it will be seen to be quite normal for this class of material, as it consists of pearlite (dark) and cementite (white), all the carbon being in the combined form. The metal was annealed in a silica tube resistance furnace, the temperature of which could be altered by means of four variable resistances, and read direct from a Cambridge indicator connected to a platinum—platinum-rhodium thermo-couple. It was found more convenient to heat for short periods of from six to nine hours at a time instead of one continuous annealing. In order to reduce oxidation and subsequent decarburisation, the specimens in the original experiments were annealed with a packing of China clay. As this did not have the desired effect, later experiments were carried out under reduced pressure.

Fig. 1.—Showing Fracture along Graphite Planes.

Fig. 2.—Nodular Graphite Malleable Iron.

Fig. 22.—× 250. (As Received.)

Summary of Results.

Thirteen experiments were carried out, in which the temperature of anneal varied from 750 to 1150 deg. C., and the results are shown in Table 1. When the metal had been sufficiently annealed, a surface of the specimen was ground and polished. It was then examined under the microscope and photographed. The resulting micrographs are shown in Figs. 4 to 14, and are extremely interesting when considered with Table I. In passing, it should be noted that the precipitation of the temper-carbon is liable to be masked, particularly in the case of thin castings, if the iron be heated in an oxidising atmosphere. There is always a tendency for decarburisation to take place. This is encouraged in the manufacture of malleable castings by the European process, but not in the American process, which is finding greater application in this country. In the former process much of the carbon is removed by the oxidising effects of the packing material, so that in very thin castings there is often less than 1 per cent. of total carbon. In the Black-heart process, however, practically all the carbon is precipitated as temper-carbon, and decarburisation is confined merely to the edge of the casting.

Discussion of Results.

In the introduction it was shown that long flakes of graphite were far more harmful than the rounded nodules of temper-carbon found in good malleable iron, *i.e.*, the physical properties may be predicted from a study of the graphite in the iron. It was mentioned also that in the manufacture of malleable castings the lower the annealing temperature, the better the properties of the casting. Such a fact would be expected when we consider the micro-structure of the resulting irons. The photographs, which are arranged in order of ascending temperature, show that there is a gradual change in the shape of the precipitated carbon from the circular form of true temper-carbon to the flaky form of primary graphite. The annealing of No. 4 at 750 deg. is altogether insufficient; in fact, precipitation of carbon has just begun. Fig. 5 at 860 deg. shows typical nodules of temper-carbon, and although the length of annealing was insufficient, the temperature employed would yield a very satisfactory product.

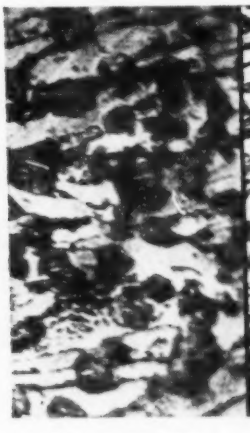


Fig. 3.—× 250. (As Received.)

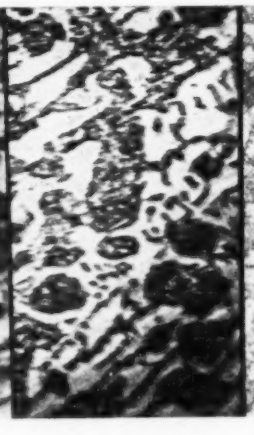


Fig. 4.—× 200. (46 Hrs. at 750 Deg. C.)

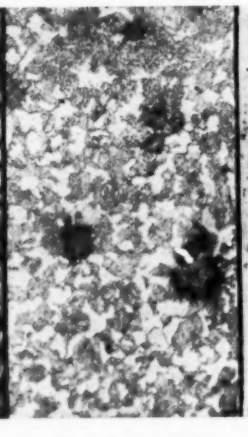


Fig. 5.—× 200. (860 Deg. C.)

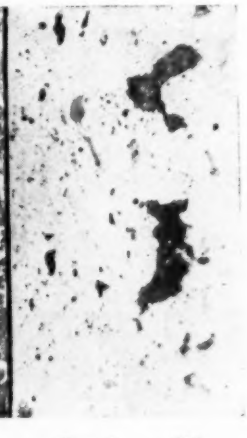
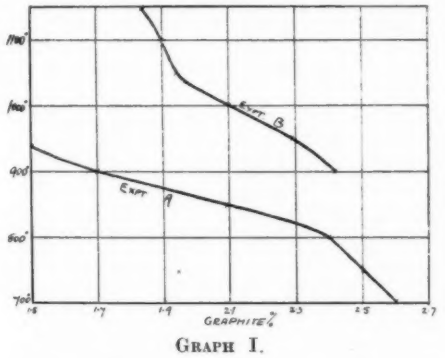


Fig. 6.—× 200. (900 Deg. C.)

As the temperature ascends the increasing flakiness of the graphite is shown; Fig. 9 at 1100 deg., for example, shows distinct primary graphite flakes, and it may safely be assumed that the physical



GRAPH I.

properties will consequently be poor. In general, therefore, the physical properties of annealed castings of given composition will vary from those of good malleable to those of a grey iron casting, according to the annealing temperature. If it were possible, during the solidification of grey cast iron, to cause the graphite to occur in the nodular form as it does in good malleable cast iron, there is every reason to suppose that the iron would be as strong and as ductile. Most white irons used in the European process have fairly high content of sulphur, which happens to be one of the elements which tend to prevent the graphitisation of cementite. As it is known that the rate of graphitisation increases with increase of temperature, manufacturers of white heart iron have to employ a somewhat higher annealing temperature to hasten the process of malleableising. From what has been said before, it is natural to suppose that if manufacturers stipulated for an iron containing less sulphur, lower annealing temperatures could be adopted without increasing the time of anneal, and consequently a superior product would be obtained due to the improved form of temper-carbon produced at the lower temperatures.

Conclusions.

From Part I of the Paper the following conclusions may be drawn:—

(1) The eutectic temperature for the particular white iron under review is in the neighbourhood of 1145 deg. C.; samples heated above this temperature show no signs of graphitisation. It therefore appears likely, at least in the case of hypo-eutectic alloys, that graphite is not the constituent separating from the melt.

(2) In the case of samples heated well above 1000 deg. C., the carbon which is precipitated tends to assume the form of primary graphite, *i.e.*, thin flakes which break up the continuity of the metallic matrix, thus reducing considerably the strength of the iron.

(3) The typical rounded form of temper-carbon is produced at temperatures well below 1000 deg. C., the lower the temperature (within limits), the more compact the carbon, and consequently the greater the malleability of the casting.

(4) There appears to be a definite change between specimens Nos. 4 to 7 and Nos. 8 to 12, *i.e.*, a critical temperature between 990 and 1050 deg. C., at which the carbon changes its form from spherical to flaky. It is suggested that this is related to the thermal points found by Carpenter and Keeling[4], between 1000 and 1100 deg. C.

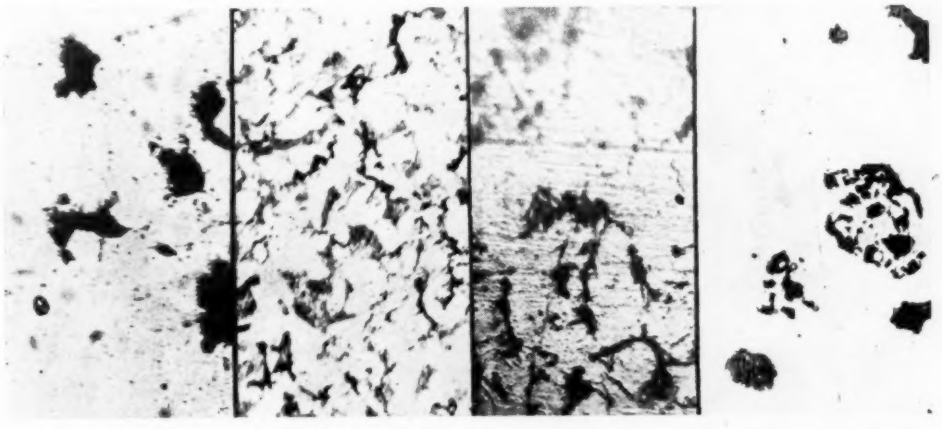


FIG. 7.—× 200. (990 DEG. C.)
FIG. 8.—× 200. (1,050 DEG. C.)
FIG. 9.—× 350. (1,100 DEG. C.)
FIG. 10.—× 200. (1,100 DEG. C.)

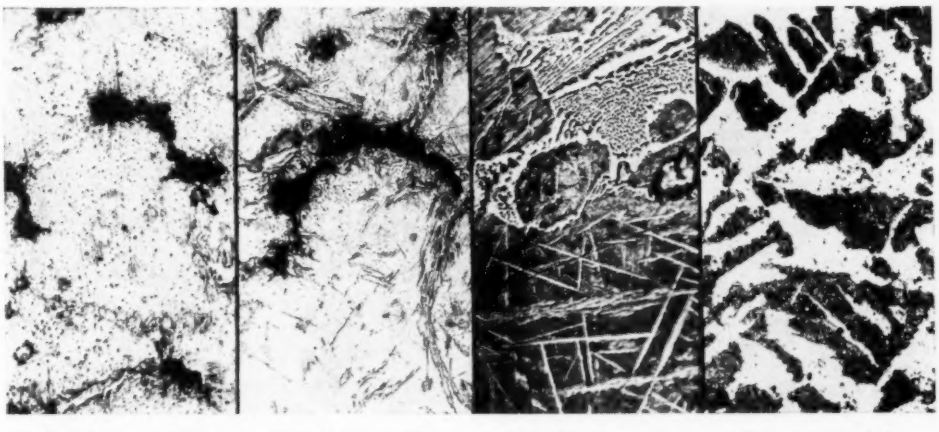


FIG. 11.—× 150. (1,140 DEG. C.)
FIG. 12.—× 150.
FIG. 13.—× 200.
FIG. 14.—× 250 (1,150 DEG. C.)

4. "Journal Iron and Steel Institute," 1904, I, 224.

(5) In a white iron, the higher the annealing temperature (as long as 1145 deg. is not exceeded), the more rapid is the formation of graphite. This is the cause of the high annealing temperatures employed in the white-heart process, necessitated by the unbalanced content of the elements present. It has been suggested that a composition which permitted lower annealing temperatures to be employed would give a superior and more uniform product.

(6) Conversely, there is a temperature, depending upon the composition of the white iron, below which the amount of graphite which separates is negligible.

(7) By employing a very oxidising packing material and a high temperature, it is possible to eliminate completely all elementary carbon, leaving only ferrite and pearlite. Ultimately also the carbon in the pearlite is oxidised and only ferrite remains.

PART II.—THE FORMATION OF PRIMARY GRAPHITE IN A TYPICAL GREY CAST IRON.

Previous workers have for the most part confined their attention to the total amount of graphite formed[5], although Wust[6] and Honda[7] quenched small samples of white iron just below the eutectic point and studied the formation of graphite with the microscope.

Annealing Experiments.

Experiments were carried out in order to trace, if possible, the mode or method of formation of primary graphite in an ordinary casting. The pig-iron employed analysed as follows:—

Total C, 3.2; Graphitic C, 2.5; Si, 1.3; S, 0.14; P, 0.04, and Mn, 0.77 per cent.

The general method of procedure was as follows:—

The pig-iron was cast into several bars (6 in. long × 1 in. dia.) in one sand box. Soon after solidification and whilst the iron was red hot, the bars were quickly transferred to a large gas muffle, heated to a pre-determined temperature. After an interval of five minutes the first bar was taken out and quenched in cold water. The temperature of the muffle was lowered and the remaining bars quenched at intervals of 50 deg. C. Samples were taken from the bars for chemical and microscopical analysis. The results of the first two experiments are shown in Tables II and III, and also in Graph I.

TABLE II.

Bar Number.	Quench. T., in deg. C.	Graphite per cent.
A1	940	1.5
A2	900	1.7
A3	850	2.09
A4	800	2.4
A5	750	2.5
A6	700	2.6

TABLE III.

Bar Number.	Quench T., in deg. C.	Graphite per cent.
B1	1,150	1.84
B2	1,100	1.9
B3	1,050	1.94
B4	1,000	2.1
B5	950	2.29
B6	900	2.42

In the third experiment the quenching temperature range covered those of the first two experiments, and the results are shown in Table IV and Graph II.

TABLE IV.

Bar Number.	Quench. T. in deg. C.	Graphite per cent.
F1	1,140	1.5
F2	1,050	1.6
F3	950	1.7
F4	900	1.9
F5	850	2.05
F6	750	2.15
F7	650	2.2

As it appeared desirable to ascertain the time required in the furnace for the bars to attain a state of equilibrium for a definite temperature, a further set of bars was cast as before and transferred to the muffle at 1000 deg. C. The first bar was taken out and quenched after five minutes in the furnace, and the other bars were quenched at intervals of five minutes. Table V shows the results of this experiment, and it will be seen that for a temperature of 1000 deg. at least ten minutes are required in the furnace for equilibrium conditions to occur.

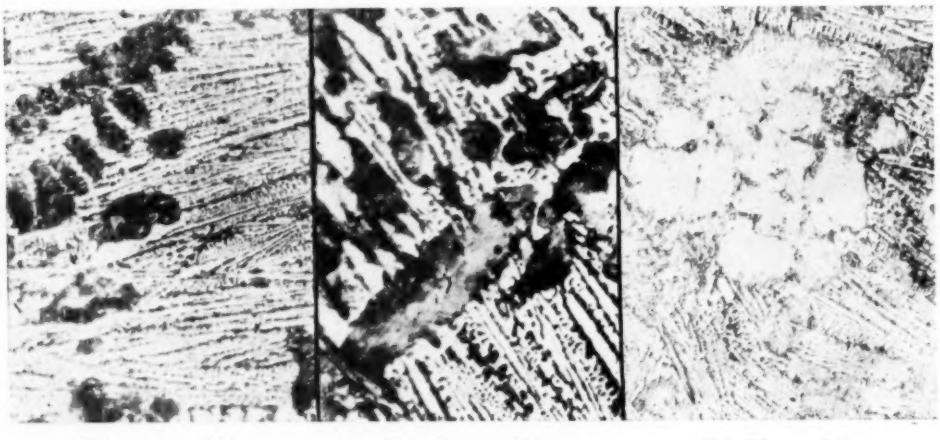
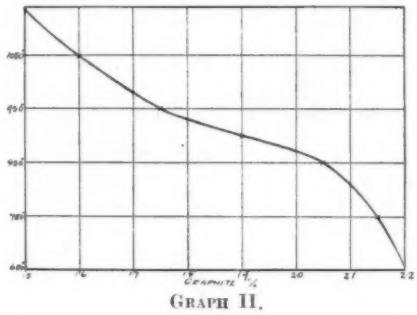


FIG. 15.—× 200. G1 (1,240 DEG. C.).

FIG. 16.—× 350. G1 (1,240 DEG. C.)

FIG. 17.—× 200. G2 (1,145 DEG. C.).



GRAPH II.

TABLE V.

Bar No.	Quench T. in deg. C.	Time Minutes.	Graphite per cent.
C1	1,000	5	2.03
C2	1,000	10	2.2
C3	1,000	15	2.22
C4	1,000	20	2.2
C45	1,000	25	2.25
C6	1,000	30	2.22

5. "Stahl u. Eisen," 1922, 42, 148. See also Hatfield, "Journal Iron and Steel Institute," 1907, 2, 79; and Brown, "Proceedings Staffs. Iron and Steel Institute," 28, 127.
6. "Metallurgie," 1909.
7. "Journal Iron and Steel Institute," 1920, 2, 287.

Discussion of Results.

From a study of Graph II it will be seen that a bar which contains 1.5 per cent. graphite at 1140 deg., on cooling to 650 deg. increases its graphite content to 2.2 per cent. This increase, however, is not constant, but the rate of precipitation of graphite first increases and then falls off again, so that at about 900 deg. there is a maximum rate of precipitation. The shape of the curve is considered to be due to the combined influence of the tendency for the formation of graphite and the increasing rigidity of the metal. It may safely be assumed that in the solid state graphite is the stable form of carbon, and not cementite. In that case, the lower the temperature from the melting point, the greater the tendency of the unstable cementite to decompose into graphite and iron. It is, however, a recognised fact that decomposition of cementite causes an expansion in the casting; that is why white irons contract much more than grey irons. With lowering of temperature, the rigidity or strength of the iron increases considerably, as would be expected, and this resists the internal expansion caused by the decomposing cementite.

In the foregoing experiments the minimum amount of graphitic carbon was 1.5 per cent. out of a total carbon content of over 3 per cent. In other words, nearly half the graphite had been precipitated before the actual investigations had commenced. Further work was necessary, therefore, to account for the first quantities of graphite formed, and it was recognised that a different *modus operandi* was called for.

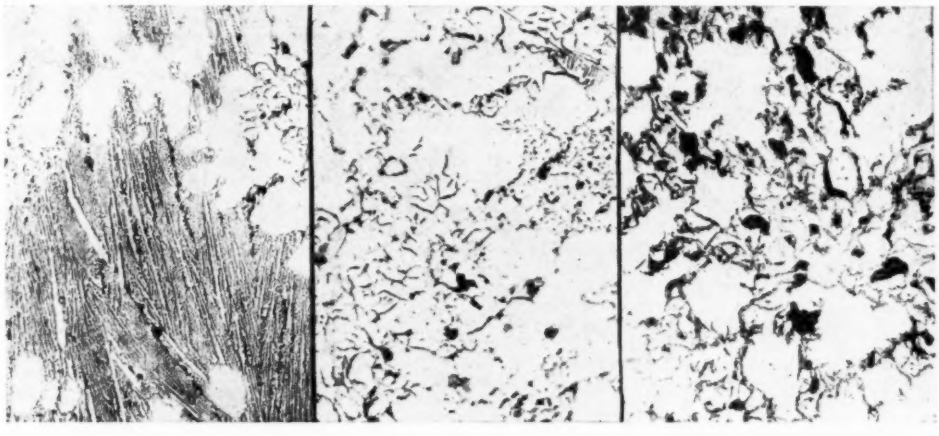


FIG. 18.—× 150.
G3 (1,083 DEG. C.).

FIG. 19.—× 150.
G4 (980 DEG. C.).

FIG. 20.—× 150.
(915 DEG. C.).

Quenching Experiments.

The iron used was an ordinary grey iron of the following composition:—

Total C, 3.4; Graphitic C, 2.7; Si, 1.4; S, 0.09; P, 0.07, and Mn, 0.9 per cent., and the method finally adopted was as follows:—

Using a small Morgan crucible as a pattern, five cast-iron moulds were prepared. One was heated to a bright red heat and into it was poured a small quantity (approximately 1 lb.) of molten iron, and the whole quenched in cold water before the iron had solidified, the temperature being determined with a nickel-chromic thermo-couple. Another ingot was poured, as before, but this time it was quenched at the solidifying point. Three more ingots were similarly poured and quenched at different temperatures below the solidifying temperature of the iron. Samples for chemical and microscopical analysis were obtained from the centre of each specimen. The results are given in Table VI, illustrated in Graph III, and microscopically in Figs. 15 to 20.

FIG. 21.—× 800.

Graph II is the most important of the curves shown. It will be seen that between the eutectic point 1145 deg. and 1100 deg. there is a critical

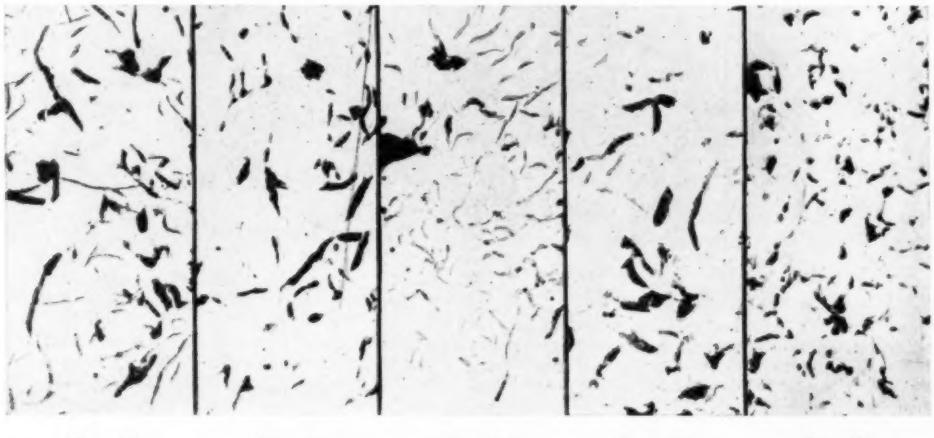


FIG. 23.
J1 A.—EDGE.

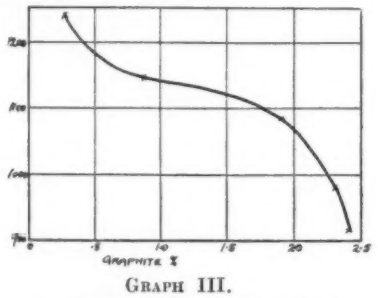
FIG. 24.
J1 B.—CENTRE.

FIG. 25.
J2 A.—EDGE.

FIG. 26.
J2 A.—CENTRE.

FIG. 27.
J3 A.—EDGE.

range in which most of the graphite is precipitated, *i.e.*, most of the graphite forms just below the eutectic temperature. It should be stated here that the actual graphite values given in Table VI do not represent equilibrium conditions, but are applicable solely to the particular case under review, with cooling rates, like those in actual practice, too rapid for equilibrium to occur. It will not be difficult to understand, however, that the general form of the curve, with in many cases different graphite values, may be applied to most grey irons and indicates the quantitative formation of graphite in grey iron castings. From Table VI it will be seen that the centre of the first specimen GI contains 0.27 per cent. of graphite, although quenching took place from the molten state. One must take into account, however, the fact that the quenched sample was comparatively large and weighed nearly 1 lb. without the mould, so that the quenching was not instantaneous. The time factor must be considered, and it is most probable that the graphite in GI was formed just below the eutectic temperature. This view is confirmed by the microscopic examination (see Fig. 16), where it is seen that part of the graphite is shown in the austenoid areas.



GRAPH III.

Graphite Content of Molten Metal.

To decide whether graphite is present as such in the particular iron under discussion when molten, a sample of the cast iron as used in the previous experiment was melted in a Salamander crucible and poured, from just above the melting point, in as thin a stream as possible into cold water, in order to obtain the maximum quenching effect. A piece of the resulting metal was cleaned and then dissolved in nitric acid of 1.20 sp. gr. and the solution filtered. No trace of graphite could be observed, showing that in molten iron graphite does not occur in its elementary form, but as a compound with iron, as iron carbide. Another specimen of the quenched iron was sectioned and polished for microscopic examination. Fig. 21 shows the micrograph (×800), and it will be seen that the quenching has been sufficiently severe to retain crystals of austenite, containing needles of martensite, but no graphite can be observed.

Equilibrium Graphite Content.

In order to determine the maximum graphite content at different temperatures, six bars were cast and treated as in the first experiments, except that each bar was held at its quenching temperature for thirty minutes before quenching. The results are given in Table VII.

The composition of the iron was as follows:—Total C, 3.4; Graphitic C, 2.7; Si, 1.4; S, 0.09; P, 1.07, and Mn, 0.9 per cent.

In Graph IV the carbon solubility curve has been plotted on the iron-carbon equilibrium diagram, and will be seen to conform fairly closely with the line usually represented as Agr, although the iron has the usual minor elements or impurities as found in commercial irons. The dotted line shows at any required temperature how much carbon is dissolved in the iron as cementite or iron carbide; the difference between these values and the total carbon content is the amount of carbon present as graphite.

TABLE VI.

Specimen.	Quench T. in deg. C.	Graphite per cent.	Micro.
G1	1,240	0.27	Figs. 15 & 16
G2	1,145	0.87	Fig. 17
G3	1,083	1.9	Fig. 18
G4	980	2.3	Fig. 19
G5	915	2.4	Fig. 20

TABLE VII.

Bar Number.	Quench T. in deg. C.	Graphite per cent.
H1	1,100	2.2
H2	1,000	2.3
H3	900	2.45
H4	800	2.65
H5	700	2.8
H6	600	2.9

Effects of Casting Temperature.

It is now well known that casting temperature has a bearing on the physical properties of the iron. Longmuir pointed this out twenty years ago. Other workers have since carried out investigations on the same subject. It appeared desirable to ascertain the effect of pouring temperature on graphite formation, bearing in mind, as mentioned previously, the influence of the size and shape of the graphite on the properties of cast iron. The iron used in this experiment was similar to that of the previous experiment. Five bars were poured from the same crucible, at temperatures ranging from 1410 to 1210 deg. C. The bars were broken and samples obtained for microscopical and chemical analysis. Hardness tests were carried out on the micro-specimens, using a 10-mm. ball for the centre and 1 mm. ball for the edge of the specimen, on a surface at right-angles to the length of the bar. The full results are given in Table VIII and shown in Graph V. It might be expected that a decrease in graphite content would tend to increase the hardness, on account of the implied increase of the hard cementite constituent in the mass. This supposition in general is borne out by

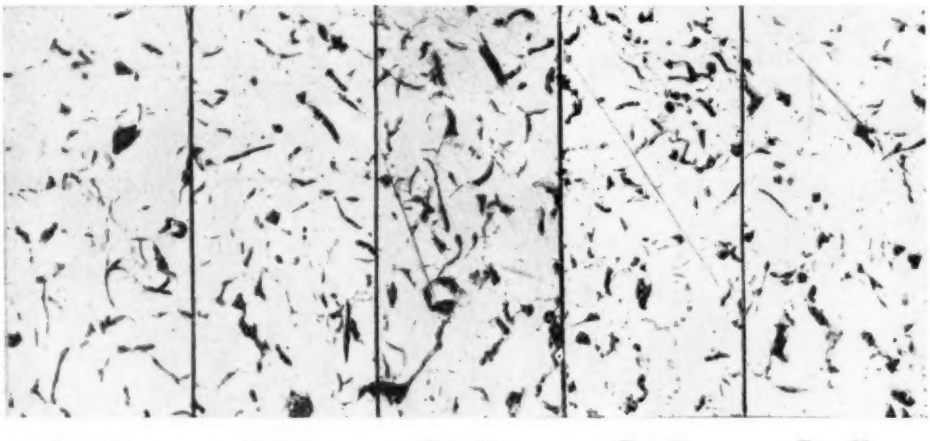
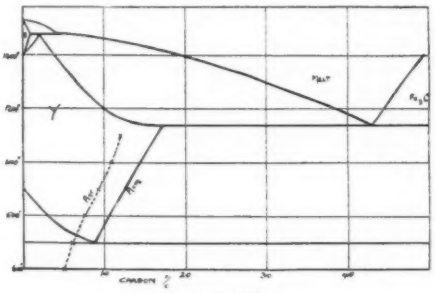


FIG. 28 J3 B.—CENTRE. FIG. 29. J4 A.—EDGE. FIG. 30. J4 B.—CENTRE. FIG. 31. J5 A.—EDGE. FIG. 32. J5 B.—CENTRE.

the curves shown in Graph V. In addition, it will be noticed that although the graphite content of the centre of the bars does not vary considerably, there is a continual decrease in the graphite on the edge.

Referring now to microscopical evidence: micrographs were taken of each specimen at the centre and near the edge, at a magnification of ×100 dia.



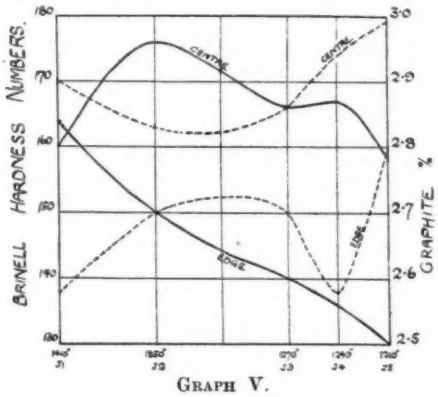
GRAPH IV.

and unetched (see Figs. 23 to 32). The comparatively large size of graphite flakes in the centres of the first three specimens contrasts largely with the size on the outside of the last three specimens. There is a distinct connection also between the hardness and size of graphite flakes, it being possible to correlate the graphite size with the shape of the hardness curve, both for the centre and the

TABLE VIII.

Specimen and Quenching T. in deg. C.	Brinell No. for centre of specimen.	Brinell No. for edge of specimen.	Graphite per cent. in centre.	Graphite per cent. at edge.
J1 1,410 ..	170	138	2.8	2.84
J2 1,350 ..	163	150	2.96	2.7
J3 1,270 ..	166	150	2.86	2.6
J4 1,240 ..	174	138	2.87	2.56
J5 1,210 ..	179	159	2.78	2.5

edge of the specimens; in other words, increase in size (referring now to dimensions, not percentage by weight) corresponds to decrease in hardness. This is shown by J3 and J4 centres. J4 is harder



GRAPH V.

than J3, although its graphite content is not less, but the average size of individual flakes is smaller. Similarly a comparison between the edges of J3 and J4 shows that although J4 has the smaller graphite content, it has the lower hardness number, due to larger size of its graphite flakes.

Conclusions.

The following conclusions may be drawn from the work described in Part II of this Paper:—

(1) Free graphite is not present in molten cast iron, but the graphite which is present in a casting results from the decomposition of cementite in the solid state.

(2) On cooling from the liquid condition, the iron precipitates most of its graphite just below the solidifying point, *i.e.*, between 1145 and 1000 deg., in the particular iron under review.

(3) Smaller quantities of graphite are produced below 1000 deg. C., due to the decomposition of the pro-eutectoid cementite.

(4) In one sample of cast iron it is shown that whilst after annealing at 1100 deg. the graphite content is 2.2 per cent., on slowly cooling to 600 deg. and annealing at that temperature the graphite is increased to 2.9 per cent.

(5) At 1000 deg. equilibrium of graphite content is obtained after a very short anneal.

(6) For any particular iron there is a definite graphitic carbon content under conditions of equilibrum for any given temperature.

(7) The graphite at the time of formation assumes the curvey flaky shape similar to that found in the final casting:

(8) Decreasing the pouring temperature lowers the graphite content, particularly on the outside of the bars.

(9) In the case under review the highest pouring temperature yields an iron with more graphite on the outside than in the centre.

(10) Graphite size is greater at the centre than at the edge.

(11) Increase in size of graphite tends to decrease the hardness.

(12) In general the less the graphite, the harder the iron.

Finally, the author wishes particularly to thank Professor T. Turner, under whose direction the work was carried out, for the many useful suggestions and criticisms made during the course of this research.

THE INDUSTRIAL COURT has delivered judgment with reference to a claim for an advance in wages by the smelters and desilverisers in the lead-manufacturing industry. They decided that the advance agreed upon by the Joint Industrial Council for other classes should apply to firms employing the workers concerned, in so far as it may be necessary to bring the minimum basis rate in Grade I towns up to 1s. 1½d. per hour.

A COMPANY has been formed with a capital of 30 million pesetas (say £1,000,000), in which the German firms of Tradt and de Bac have an interest, as well as the Fried. Krupp Germaniawerk, to combine certain Spanish shipbuilding interests. The shipbuilding yards taken over are the "Nuevo Vulcan," of Barcelona, recently destroyed by fire; the "Astilleros de Tarragona," with plant and floating dock; the yards belonging to the Trasmediterranea Company, at Valencia, and "Talleres Gomez," also of that port.

INDIAN STEEL PROTECTION BILL.—A cable from Simla states that in the Legislative Assembly on June 4 Sir Alexander Muddiman said it was hoped to discuss the resolution proposing that the Government should take no immediate action on the Lee Commission Report. A discussion on the Steel Bill ensued, and Mr. Patel's amendment, that bounties on steel rails and fishplates should only be allowed to companies with two-thirds of Indian capital, was argued with much warmth. Sir Basil Blackett gave the Assembly an assurance that the Government would consider measures for regulating the influx of foreign capital in conjunction with a Committee of the House. Sir Charles Innes made an appeal to the Assembly not to imperil a great industry, and place the Government in an awkward position. Finally the Pandit Motilal Nehru proposed an amendment in which he suggested that the Government should declare its policy, but Sir Charles Innes said he was unable to accept it as it stood. The House eventually adjourned without arriving at any decision. In the resumed discussion on the Steel Bill on June 5 an amendment that agricultural implements should be exempt from the 25 per cent. duty, and remain under the present *ad valorem* duty of 15 per cent., was carried by 48 votes to 37. The Pandit Motilal Nehru proposed an amendment that no bounty for steel rails, fishplates or wagons should be payable to any firm or person not already engaged in the business of manufacture, unless such firm or person provided facilities to the satisfaction of the Governor-General in Council for the technical training of Indians in the manufacturing processes involved in the business, unless the firm had been registered under the Indian Companies Act of 1913, had a share capital of rupees and a proportion of Indian directors prescribed by the Governor-General. The amendment was accepted by the Assembly, only seven members objecting. On Dr. Gour's suggestion, the duty on tinplates omitted by the Select Committee was restored. Mr. Fleming's amendment that Burma should be exempted from the Bill was negatived. The Bill was then finally passed after a four days' discussion. The Council of State has since passed the Bill without amendment.

XUM

Economical Melting with Cupolas.*

By H. Van Aarst (Holland).

The demand for fuel is worldwide. In consequence of the world war, followed by strikes and other troubles, the production of coal and coke has materially decreased. The restlessness all over the world induces gloomy views for the future, and the regular supply of fuel is still by no means guaranteed. Therefore, economy in fuel is essential. This is well known, but the principles of its economical use are but little appreciated.

As a large quantity of fuel is needed for foundry work, this Paper is addressed more particularly to foundry managers and those connected with foundries.

"Few strokes fell great oaks" is a proverb that is certainly applicable to the melting of iron. What are these strokes? Some of them may be enumerated as follows:—

Insufficient air-supply causes an incomplete combustion of coke, the melted iron becomes dull and is not mixed, castings made of this material are often wasters.

Excess air-supply oxidises the iron, as not all the oxygen can be combined with the carbon of the coke. This excess of air burns the iron.

Insufficient limestone, added to the fuel and the iron, makes a thick and viscous slag, the tuyeres will be made up the tap- and slagholes being cleaned only with difficulty.

However, it is apparent that between too much and too little, the "correct" must be found. It is intended to deal with these matters in order to find the "correct."

Referring to Fig. 1, cupola practice may be described as follows:—Having attended to the lining and inspected the tuyeres (sometimes there are small pieces of slag or coke found lying in these holes), the bottom door No. 11 and the door of the receiver (fore hearth) can be closed, the sand bottom in the cupola can be made up. About two hours before the starting to melt, the cupola must be lighted by wood, peat or coke fire. When this fire is burning well, the bed-coke can be added, door No. 10 remaining open and the bed-coke allowed to burn through till the half of the quantity is added. The cupola is thus warmed all over gradually and the lining will not crack or burst.

Door No. 10 can now be closed, and blowing started. The air goes through the tuyeres into the cupola, passes through the bed and up the stack. A quantity of the warmed air passes also through the channel to the receiver, slag and tap holes, so that all parts of the cupola are heated intensively.

The heated cupola can now be filled completely through the charging door with coke, iron and limestone, added in definite proportions and quantities. Slag and tap holes must now be shut, after which the melting process starts.

Melted iron and slag drip through the coke, fall upon the sand bottom of the cupola, and run through the channel into the receiver. The furnaceman has to exercise care so that the fluid material—iron and slag—does not rise too high in the receiver. He must tap off before the material can approach the peephole. When the melting is finished, the door of the receiver must be opened so that the remaining slag can run off.

The bottom door of the cupola must also be taken away to prevent the rest of the slag and coke remaining in the furnace. After this resumé of the melting process, which is known to all founders, it is proposed to discuss the different factors which may influence it.

The Influence of Iron on Fuel Economy.

Hard iron, with a low percentage of Si and Mn, has a higher fusing point than soft iron. It requires a higher temperature to liquefy it. Large pieces of iron are more difficult to melt than small pieces. Iron covered with sand will melt less easily than clean iron. Moreover, the required temperature of the metal will depend upon the sizes of the castings to be made. Thin castings, for instance, need an iron of higher temperature than heavy ones. The transport of the liquid iron in the foundry must also be taken into consideration.

In the first instance, the foundryman must take into consideration for what purpose the melted iron is to be used, after which the quantity of coke must be determined.

The different temperatures are approximately as follows:—Cold iron, 1,200 deg. C.; warm iron, 1,260 deg. C.; hot iron, 1,320 deg. C.; very hot iron, 1,380 deg. C.; extraordinarily hot iron, 1,450 deg. C.

Coke Considerations.

Now the quantity of coke must be determined. Good coke is hard and coarse, and consists of 84 per cent. C, 10 per cent. ash, 1 per cent. S, and 5 per cent. water. Bad coke is porous, and the specific gravity is low; also it has a higher percentage of ash and sulphur.

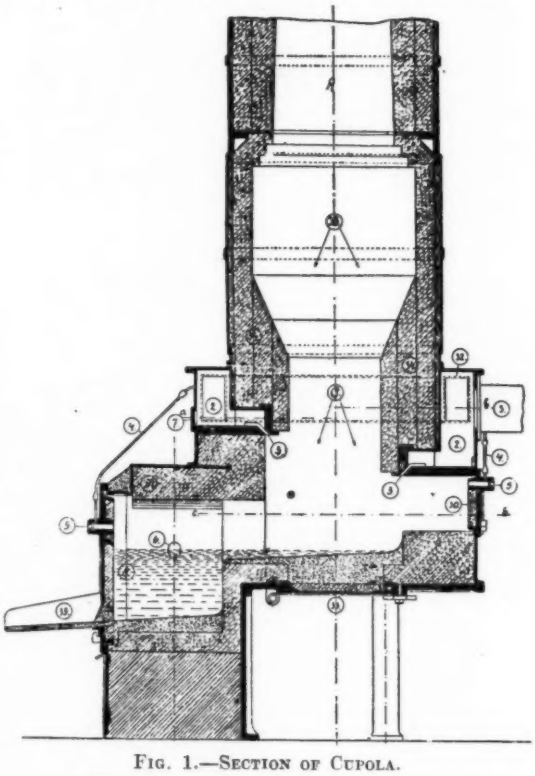


FIG. 1.—SECTION OF CUPOLA.

A, Filling shaft; B, Heating zone; C, Melting zone; 1, Air inlet; 2, Wind belt; 3, Tuyeres; 4, Cooling tubes; 5, Peep holes; 6, Slag notch; 7, Valve; 8, Door in receiver; 9, Shutter; 10, Side door; 11, Bottom door; 12, Cover on wind belt; 13, Tapping spout; 14, Brickwork.

The combustion of coke can take place in two ways. When there is much air, and therefore much oxygen, one part of carbon combines with two parts of oxygen ($C + O_2 = CO_2$).

From this combustion carbon dioxide is produced with the evolution of 8080 calories. If there is too little air and too little oxygen, 1 of oxygen combines with 1 of carbon ($C + O = CO$), producing carbon monoxide with an evolution of 2,473 calories, or only one-third of the calories developed by full combustion. Thus, it is of the utmost importance to further the formation of CO_2 as much as possible.

It is easy to enunciate the platitude, "Take care to have sufficient air-supply." However, this is not so easy as it seems to be, as CO_2 cannot exist at any temperature. The escaping gases of the cupola chiefly consist of nitrogen, carbon dioxide, and carbon monoxide. Neglecting the nitrogen and considering only the carbon dioxide and monoxide, it is known that both can exist up to 400 deg. C. The higher the temperature

* A Paper presented to the Newcastle Conference of the Institute of British Foundrymen.

becomes, the less carbon dioxide will be formed. This continues up to 1,000 deg. C., at which temperature they cannot exist at all.

There are, however, two opposite factors: (1) The coke, requiring a large air-supply, in order to assure the greatest possible useful efficiency; and (2) the peculiarity of the carbon dioxide to dissociate at a temperature above 400 deg. C.

The Influence of the Mechanical Properties of Coke.

Hard, coarse coke imposes more resistance to the pressure of the upper layers of iron, coke and limestone than porous coke. More space will be occupied by the latter. With coarse coke there can pass more oxygen than with porous coke, and less surface of carbon is also exposed to the passing oxygen. The CO_2 combination, to be associated with good melting process, will assume its correct position, just as is required. Porous coke will give the opposite result, as the oxygen in passing meets a large surface of carbon, giving a combination of CO as a result. This uses more carbon with the same quantity of oxygen; additionally, both more oxygen and coke are required.

In many foundries it is usual to make charges of 5 cwt. It is better to use 10 cwt. The latter quantity of coke for each charge will give a better

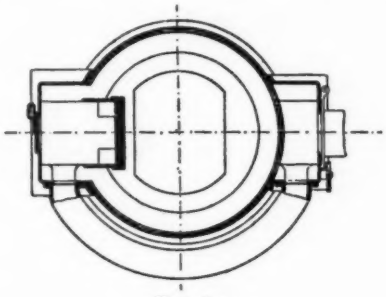


FIG. 1A.

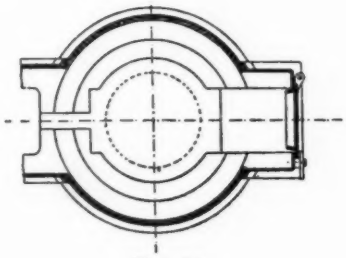


FIG. 1B.

result when using hard coke. It will stand pressure and friction in the cupola better, and facilitate the descent of the material. The pulverisation will not be so great. The quantity of coke needed in a well-conducted furnace varies between 8 to 10 per cent. of the quantity of iron to be melted. It must be understood that this percentage also depends upon the quality of iron and coke used.

An important factor when melting is the quality of limestone. The limestone serves to make slag of the ash of the coke and to desulphurise the iron and coke. The slag may be either a thin fluid or a thick syrup. Liquid slag proves that sufficient limestone has been used. A thick one indicates the contrary. A thick, viscous slag may be disadvantageous, because the tougher the slag the easier it fastens itself near the tuyeres or into the channel of the receiver, in which case the melting process will be disturbed.

This type of slag is very difficult to remove out of the cupola and receiver, so that—when cleaning the lining—the firebricks will be damaged severely.

The thin, fluid slag is of great importance for the refining of the melted iron. The molten iron looses some of its sulphur existing, chiefly rich sulphur-manganese alloys, which are lighter than molten iron and rise to the surface. A fluid slag will take up these impurities, and the more fluid it is the better will it do so.

It is worth recommending to tap the slag often, in order to prevent the slag from clinging to the lining and to keep the slag fluid and fresh. The correct colour for cold slag is glittering-black and very brittle. If it is dead-black, hard, and contains iron, there is something wrong with the melting process. Very often the fracture of the slag is yellow-green.

The quantity of limestone necessary when melting depends upon (1) the quality of coke, (2) the kind of iron to be melted, and (3) the lining of the cupola.

Generally speaking, one may use 25 to 30 per cent. limestone of the quantity of the melting coke.

Air Supply.

Coke, limestone, and air-supply form a triple alliance, completing one another during the melting process. With an open fire with natural draught, the air supply constantly regulates itself with incomplete combustion. This is by no means the case when iron is melted with forced draught.

It is well known how necessary it is to use an exact quantity of air in order to obtain the most economical result of a good combustion. Insufficient air-supply gives an imperfect combustion of coke. On the other hand, excessive air-supply oxidises the iron and causes metallic losses. With an accelerated air-supply the gases, leaving the cupola, have too high a temperature; this is also a disadvantage. A perfect combustion of the coke has practically been found by using 8 to 10 cub. metres of air for 1 kilo of iron.

To calculate the amount of air used in the cupola, it is necessary to know the speed and the pressure of the air-supply. The speed can be controlled by using a Pitot tube (Fig. 2), which is placed, filled with water, as near the tuyeres as possible. The difference h in both pipes is also the length of the air column. If this h is 12 mm., this means 1.2 gr./cm². One cub. metre of air weighs at 0 deg. C. (760 cm. barometric pressure) 1.293 kilos. Assuming that the temperature of the passing air is 15 deg. C., and neglecting the position of the barometer, 1 cub. metre of air weighs 1.2 kilos or 1 cub. decimetre 1.2 gramme. On a base of 1 cm² the height of the air-column of 1.2 gramme becomes 1,000 cm. or 10 metres. Consequently the length of the air-column, corresponding with a water-column of 12 mm., is 10 metres.

The further calculation is as follows: When an object is falling from a height of h, it is well known that the acceleration is 9.81 metres every second. The speed upon the ground is found by the formula $V' = V'2gh$.

Instead of a solid body, foundrymen have to deal with air, which gives the following result when falling:—

Speed $V' = V'2gh = V'2 \times 9.81 \times 10 = V'196 = 14$ metres per second.

By multiplying 14 metres per sec. by the section of the tube, the number of cubic metres of air per second is found.

Instead of the Pitot tube, there are also self-registering metres. They work on the same principle. One advantage is that they indicate all fluctuations of the melting process and control the actions of the furnaceman.

Cupola Linings.

Fig. 1 shows the construction to be divided into three main parts—charging shaft, heating zone, and melting zone. The bottom of the charging channel is somewhat enlarged in order to prevent the well-known difficulty of "hanging" of the material which often occurs in ordinary cupolas. That this hanging causes difficulties and bad melting results needs no explanation. Wherever the lining has burnt away it is necessary to rebuild it as soon as possible to prevent this occurring. The escaping gases will also be more free to leave the cupola chimney. The heating zone has a larger diameter than the upper part for two reasons: (1) Each time the charges fall on the enlarged coke bed the escaping gases are not obstructed and meet less opposition, and (2) above the melting zone there is a lower temperature with this construction than with a straight-lined cupola. The formation of carbon dioxide is promoted, the heat is better utilised.

The melting zone is the part for the melting process. Here the iron is melted and every

obstacle which can take place before entering this part of the furnace is removed. Here the coke burns, the iron melts, and slags are formed. There is a continual movement there, the heated gases going upwards to the chimney, the melted iron running down to the bottom and receiver. The slag runs slowly to the bottom, often giving the furnaceman great trouble, especially when it adheres to the tuyeres, obstructing them or the channel to the receiver.

To prevent these difficulties, Fig. 1 shows how the tuyeres are built into the lining. The slag can pass these holes without causing any trouble.

Foundrymen must be sure that on the side of the receiver no difficulties arise from slag adhering to the tuyere. This cannot always be ascertained from the opposite side of the tuyere, as the coke lying near will be soon chilled by the blast. The dripping slag will cool there, and gradually the tuyere will be filled with slag and unburnt coke.

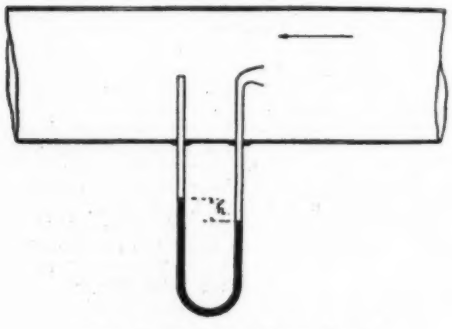


FIG. 2.—SHOWS A PITOT TUBE.

To prevent this difficulty the entering air must be divided as shown in Fig. 3B (Fig. 3A shows the wrong method). The coke lying in front of this hole will also burn much better. Thus there is a regular air supply, which is of the greatest importance to a good melting process.

Successively the author has discussed the different factors influencing the melting process. Now he wishes to draw attention more especially to the escaping gases. For this purpose it is necessary to go on the platform and inspect the gases passing up the cupola into the chimney. Sometimes these gases are white, transparent blue, and sometimes they are invisible. Sometimes there is directly upon the top of a charge a yellow-rose flame. To these phenomena it is desirable to draw attention, as they are the easiest to control, for after the combustion process a smoky flame indicates the incomplete combustion. White-coloured flames at the charging door during the melting process means incomplete combustion. These gases arise from too little air supply, more air being required. If the gases are invisible it may be that there is perfect combustion. However, care is essential. If the liquid iron is cold increase the air and coke supply. If possible try to regulate the combustion in such a way as to obtain a transparent light-blue coloured flame at the charging door. The fuel consumption is but a little higher, but then one can be more certain of a regular melting process, and in cases of breakdown the metal can stand a little time. A yellowish-rose

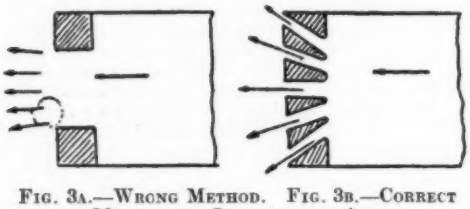


FIG. 3A.—WRONG METHOD. FIG. 3B.—CORRECT METHOD OF INTRODUCING AIR.

flame shows that the temperature above the melting zone is too high, and a considerable loss of heat is the result.

The object of this Paper has been to show how to be economical with fuel in the cupola, and to make it understood how much there is to be done in this respect.

The iron to be melted determines the quantity of coke, the coke determines the air and limestone supplies, whilst the limestone influences the combustion. The height of the cupola is still another factor.

To save coke one has first to know what happens during the melting process. The knowledge of this subject is still very incomplete.

In the English, American, and German literature on this subject one finds different lectures, more or less scientific, derived from experiments by many foundry engineers in order to come to a more economical fuel consumption, less loss of iron, or to find pointers for the difference between iron which is or has to be melted.

For practical foundrymen it is thought that this Paper will be sufficient for their own practice, as it is taken and built up from experiments made by the author. It is hoped that this article may animate many foundry workers to improve their own methods. If these experiments are taken carefully and seriously, and if one does not mind meeting and overcoming difficulties, one is sure that better results will be obtained. The fuel consumption will decrease gradually, the iron will be melted more regularly, and the repair of the cupola will cost less.

Desulphurising Coke with Steam.

Experimental work on a laboratory scale on the desulphurisation of coke by steam, conducted by the Department of the Interior and the Carnegie Institute of Technology at the Pittsburgh Experiment Station of the American Bureau of Mines, has demonstrated that the steaming process effects a greater sulphur removal than is possible with other processes. The economic importance of the results of these experiments is that they point the way to future utilisation of enormous reserves of high-sulphur coals not now suitable for coke making.

In a report giving the results of these experiments, made by Alfred R. Powell, associate chemist, Bureau of Mines, and John H. Thompson, research Fellow, Carnegie Institute of Technology, it is pointed out that sulphur in metallurgical coke gives rise to many problems and difficulties in furnace operations.

The investigators at the Bureau of Mines laboratories found that between 10 and 15 per cent. of the total sulphur in the coke is removed by simple steaming at 750 deg. C. With alternate vacuum and pressure treatment the desulphurisation is increased to 20 to 25 per cent. Furthermore, it is believed that the steaming is much more beneficial than the actual sulphur reduction indicates, since the sulphur removal is almost entirely taken from the surface of the coke, and this surface sulphur may be the part that is easily absorbed by the iron in the blast furnace.

The recent rapid growth of the by-product coking industry serves to simplify the matter of a cheap steam supply. Large quantities of heat are now allowed to go to waste, but this heat could be well utilised in the generation of steam. Thus the process of steam coke could be made comparatively inexpensive.

The results of this investigation are embodied in Bulletin 7 of the Coal Mining Investigations Series, which may be obtained from the Carnegie Institute of Technology, Pittsburgh, Pa., at a price of 30 cents.

Trade Statistics.

French Iron and Steel Imports and Exports for the First Three Months of 1924.

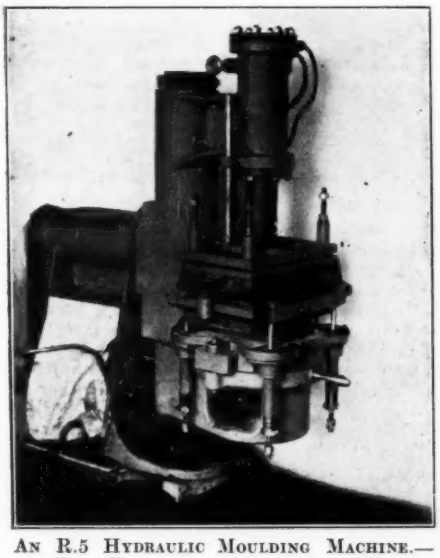
French iron and steel imports for the first three months of 1924 included the following items in metric tons:—Pig-iron: 13,037 tons; ferro-alloys, 395 tons; steel ingots, 7,553 tons; blooms, billets, etc., 78,851 tons; rails, 292; plates and sheets, 20,031; special steels, 2,496; hoops, 22,267; wheels, axles and tyres, 587; wire rods, 11,319; wire, 2,880; wire nails, 271; tubes, 5,495; tinplates, 9,158; springs, 21; castings, 1,453; structural iron and steel, 1,406; scrap, 54,590; total, 232,102 tons. The imports of tinplates included 5,501 tons from Great Britain and 3,371 tons from the Saar.

(*Continued from page* 508.)

The Universal System of Machine Moulding and Machinery Company, Limited.

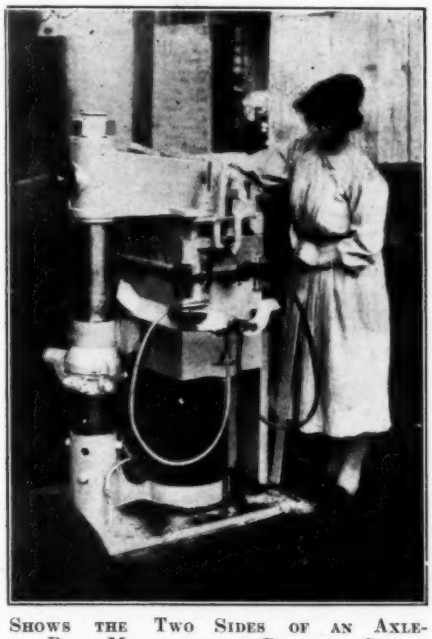
This firm, whose office is at 97, Queen Victoria Street, London, E.C.4, are the British agents for Messrs. Bonvillain and Ronceray, of Paris.

As usual, they have a most comprehensive range of hydraulic moulding machines, which are shown under working conditions.



AN R.5 HYDRAULIC MOULDING MACHINE.—THE UNIVERSAL SYSTEM OF MACHINE MOULDING COMPANY.

R.5 and E.5 Machines.—The R.5 machine is a small roll-over machine, very rapid and very easily operated. This, together with the E.5 machine, work in pairs, and are shown principally engaged in giving a demonstration of moulding for the new British standard axle-box. Pattern plates will be supplied of these particular axle-boxes. These

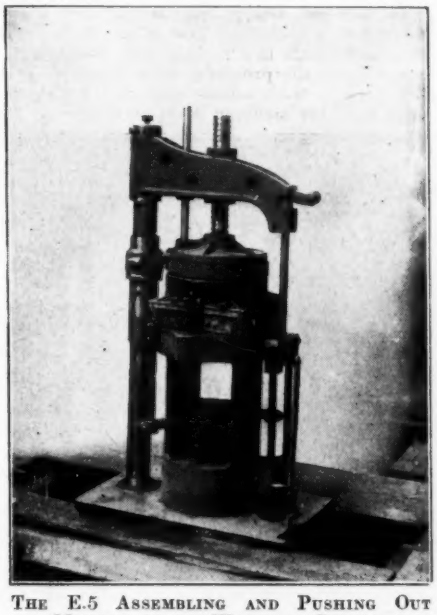


SHOWS THE TWO SIDES OF AN AXLE-BOX MOULD BEING RAMMED SIMULTANEOUSLY.—U.S.M.M. COMPANY.

are made on the Ronceray principle, by which pattern plates, stripping plates and core boxes are made in metal without any machining.

DF.4 Machine.—This machine is well-known, and is stated to be the fastest machine in the world for its particular sphere of work, which is of a shallow nature. It will be shown in operation. This machine has been completely re-designed, and its speed has been increased.

2.LP.5 Hand Moulding Machine.—This machine has a double table, and the ramming head can be swung over either table, so that the cope can be made on one side of the machine and the drag on the other side. No power is needed for this machine and no foundations. The machine is fitted up with pattern drawing stools, which are actuated by the foot-lever.



THE E.5 ASSEMBLING AND PUSHING OUT MACHINE WHICH WORKS IN CONJUNCTION WITH THE R.5.

SL.5 Assembling and Pushing-out Machine.—This machine is operated by hand. The moulds are made on the 2.LP.5 machine, and are assembled and pushed out on the SL.5 machine, thus enabling the castings to be made without boxes.

The firm's well-known *Oil-sand Mixer* is being shown together with a new type of sand mill, a

SHOWS THE PATTERN PLATE WITHDRAWN AND THE MOULD BEING CLOSED.—U.S.M.M. COMPANY.

description of which recently appeared in the columns of THE FOUNDRY TRADE JOURNAL. In working this sand mill a vertical disintegrator of a new model has been installed, which embodies many new features.

JH.3 Electrical Hydraulic Jolt Ramming Machine.—This is an innovation. The valves of this machine are opened and closed by means of a little sewing machine motor. The opening and closing of these valves permits the water to pass

through the angular chamber, and which lifts and lets fall the table. The speed of jolting can be varied at will, and for making cores, and all jobs suitable for being moulded on a jolting machine, this is stated to be a most useful one.

Jolt-Squeeze Machine, EJ.3.—This machine has been designed owing to a demand for a machine to jolt and squeeze the mould, but it can also be operated as a squeeze machine only. As in all the other cases of this firm's machines, the operating agency is hydraulic pressure, working on a 750 lbs. per sq. in. In conjunction with this a new type of ER.3. roll-over machine is shown working. This

SHOWS THE MOULD PUSHED THROUGH THE BOX READY TO BE LIFTED ON THE FLOOR. —U.S.M.M. COMPANY.

is an entirely new type of machine, and it is much faster than the old type of R.3. roll-over machine, and further, a pit in the front of the machine is not now needed. In addition, a new arrangement has been fitted to this machine and also to the R.5 machine, by which the rotating action on the roll-over has been placed, that is to say, the machine rolls over very quickly until it comes to the end of the stroke, when it slows down automatically, thus preventing any bump at the end of the stroke of the roll-over.

A power assembling machine, SA.3, which operates similarly to the SL.5. machine described above, except that it is power-driven, completes the moulding machine exhibits. As usual, they show a suitable pump and hydraulic accumulator.

It is expected that M. Ronceray himself will be on the stand, which will be in charge of Mr. A. L. Beech.

Ritchie, Hart & Company, Limited.

This well-known Irish firm, whose head office is at Mountpottinger Foundry, Belfast, are confining their exhibit to two machines. The first one is a patented loam core-making machine, which supersedes the old method of running up loam cores on barrels supported on trestles with one or two men turning with crank handles. The machine has four speeds, allowing it to cope with the various operations and diameters of cores. It makes cores of from 1½ to 16 in. dia. and up to 13 ft. in length. It requires 1-h.p. motor, or it can be driven from a countershaft

The second machine is a foundry floor dresser, and has been designed to reduce overtime. It is often customary to ask a number of labourers to stay after the boxes and castings have been removed to dig over the floor ready for the following day. The object of the machine is to avoid this, as two men, one on the machine and one driving an overhead crane, can quickly turn over the floor of a foundry at the rate of 35 sq. ft. per min. to a depth of 12 in. It requires a 3.5-h.p. motor to drive it. Mr. T. W. Ridd, a director of the concern, is personally taking charge of the stand.

Stella Gill Coke & Bye-Products Company, Limited.

This firm, whose office is at 39, Lombard Street, London, E.C.3, are showing *Stella Gill Pelton* patent coke, which is suitable for all classes of foundry and blast furnace work. It is in use in all parts of Great Britain, and also in France, Germany, Belgium, Luxembourg and Italy. Its approximate analysis is:—Fixed carbon, 90.57; volatile matter, 1.7; and ash, 7.73 per cent. Its sulphur content is 0.96, and the moisture 0.48 per cent.

The Company also exhibits specimens of sulphate of ammonia, benzole, hot-pressed naphthalene, creosote, pitch, and other by-products of tar. The coke is made at Stella Gill, Pelton Fell, S.O., Co. Durham.

W. T. Nicholson & Clipper Company, Limited.

The exhibit of this firm, whose head office is at King Street, Salford, consists of specialities in connection with belting propositions.

The Improved "Klincha" Lever Belt Lacing Machine embodies many improvements, and the principal features of which are as follows:—Detachable magazine facilitating the insertion of the hooks into the machine when making the joint, and improvements enabling the machine to be operated with one hand, leaving the other free to hold the belt in the correct position while the joint is being made. It should also be mentioned that the "Klincha" belt fasteners are now mounted on an outside paper strip and built up in 12-in. lengths, preventing any lateral displacement, and making it easier and quicker to place the fasteners in the machine. The fasteners can be readily cut to any length required without disturbing the hooks. It is not necessary to take off the strips to insert the belting between the hooks, which are held in correct position, and spacing independent to the slots of the machine, and thus no time is wasted in straightening out displaced hooks, as occurs with other carded types.

The Improved "Klincha" Vice Tool is a 4-in. machine intended for use on an ordinary vice, specially suited to small users of belting.

The "Python" File and Tool Handle has a steel coil spring pressed into the centre, which is secured in its place by a specially designed ferrule. These two together take up all the pressure when the file is driven into the handle. The ferrule cannot be removed without destroying the handle. The handle grips the file tang much firmer than the ordinary handle, because the wood is compressed within the coil spring when the file is driven in. Should a "Python" handle split or the ferrule become detached it is replaced free of charge.

The "Klincha" Belt-Cutting Shears, one of the cutting blades of which is furnished with saw teeth inclined towards the handle. These teeth hold the material fast and prevent it slipping towards the point of the shears. Leather, balata and woven belting, sheet rubber washers, strips, and soft packing materials can be readily cut with square or inclined edges by this method.

The stand is in charge of Mr. F. Gunn, the Birmingham director of the concern.

The Marley Hill Chemical Company, Limited.

"Marley Hill" (Registered Trade Mark) coke is made from stamped coal carbonised in Hussener ovens, and is suitable for all classes of foundry and blast furnace work. It is in use in all parts of Great Britain and also in France, Germany, Belgium, Luxembourg and Italy. Being made from coals supplied from one mine only, its quality is particularly uniform. It shows the following approximate analysis:—Carbon, 91.2; volatile matter, 0.5; ash, 8.3; and sulphur, 0.66 per cent. The phosphorus in the ash is 0.008 per cent. It carries 2.5 per cent. moisture, and hardness test gives a figure of 96.2.

The Company is also exhibiting specimens of sulphate of ammonia, benzole, solvent naphtha, creocote, anthracene, pitch and other by-products of tar, and also examples of its sulphuric acid.

The representatives of the Company, whose head office is Milburn House, Newcastle-on-Tyne, will deal with all inquiries.

The "VULCANIA" PATENT WHEEL MOULDING MACHINE.

Patent No. 5049.

THE "VULCANIA" PATENT WHEEL MOULDING MACHINE is for moulding spur wheels with straight, sloping or Vee-shaped teeth, also bevel wheels, skew gear wheels, worm wheels and internal wheels. The machine head is carried on a pillar which is held in a base-plate bedded in the floor sand, and is made to slide on the pillar by means of a lever and link carried on a joint bearing, or by rack and pinion, or screw if thought advisable for the particular work it is being used for.

An adjustable stop collar is provided for accurately deciding the depth of mould. On the removable head a slide is carried for supporting the patterns of the teeth to be moulded. This slide is made adjustable by screw or pinion gearing to the diameter required. The number of teeth to be moulded is decided by a special dividing plate into which a steel wedge or finger engages. The special dividing plate has milled vees, at the angle of 60° inclusive, around its circumference, to receive the steel wedge, which is adjusted by a screw having an internal spring to keep it in tension and to lock the head when ramming operations are being carried out.

JAMES EVANS & CO., BRITANNIA WORKS (MANCHESTER), LIMITED.

BLACKFRIARS, MANCHESTER.

The General Refractories Company, Limited.

The exhibits of The General Refractories Company, Limited, of Kelham Island Firebrick Works, Sheffield, consist of a collection of high-class refractory materials, including, amongst others, the following specialities of this well-known firm:—

"*Yorkshire Sand*" *for Steel Foundry Use.*—This was introduced by us during the War period when foreign moulding sands were unobtainable, and rapidly took a foremost position because of the results obtained by its use, which position it has since maintained. It is admitted on almost every hand to be superior to almost any imported sand, and very few indeed of its users have reverted to the use of the foreign article.

Chrome Bricks and other Chrome Products are a speciality of this firm. They are principally used as a neutral course in between the basic magnesites and the acid silicas in open-hearth basic furnaces, and also in soaking pits. The exceptional quality of the ore used by this firm, together with the hardness and excellent shape of the bricks, has gained for them a very high place amongst basic steel makers.

Magnesite Bricks.—These bricks, made from the well-known Austrian magnesite at their own works, are also very much esteemed by basic steel makers, principally because of their hardness and excellent shape, this latter, of course, greatly facilitating the laying of the bricks in the furnaces, and ensuring good joints. For mechanically charged cupolas the insertion of either magnesite or chrome bricks is worth considering on account of their hardness.

"*Kor-Glu*" *Core Binder,* a material used by the iron, steel and non-ferrous foundries with every success for the making of cores. An examination of the cores shown will enable even a non-technical person to appreciate the necessity of a core binder being of such a nature that the core, when dried, shall be hard and strong, but yet will fall into a fine powder shortly after coming into contact with the molten metal, and thus greatly facilitate fettling or the effective cleaning out of the hole in the metal previously taken up by the core itself. "Kor-Glu" will do this, and whilst initially very cheap it is always used diluted with water, and is thus cheapened still further. Further experiments have shown this material to be excellent, when mixed with the firm's *White Silica Paint,* for coating the face of steel casting moulds and ensuring that fine blue skin so much desired by all good foundrymen.

"*Red Rover*" *Sands,* of which this firm show both their medium and superfine grades, this latter an exceptionally fine-grained sand for the better class of work. This is from the Mansfield sand beds, known and esteemed the world over, and the quarry itself has only recently been opened out, but the good quality of the sand has already found a big market.

Bramcote Moulding Sand.—A very good red sand, much esteemed by malleable ironfounders. Owing to its high porosity it needs much less venting than the usual run of sands, and has an exceptionally large circle of friends in the North Midlands district.

"*York-Yellow*" *Bonding Loam for Ironfounders* is one of those sands enabling the foundryman to make up whatever mixture he requires to suit his particular work, and further, enables him to give new life to his old spent and waste sands.

"*Crystal Core Sand*" is a special sand for core work, ready dried, packed in bags and uniform in grain, shape and size, thus giving a permeable core after stoving. There are no angular grains to inter-lock and thus give a hard core which takes up so much time in the fettling shop.

Other exhibits on the stand include the high fire-resisting materials produced by this firm, and consist of the following:—Silica bricks for lining steel and glass melting furnaces of every description; Sheffield ground ganister for lining cupolas and patching of every kind of furnace; a special new material called "Fluorcal" for use in cupolas, the composition of which is given in the booklet, and about which there is nothing secret at all; sleeves, stoppers, nozzles, runner and centre bricks for steelworks, as well as ladle bricks for the lining of steel ladles, ground fireclay, firebricks and fluxing stone; fluorspar from their own mines at Masson, Matlock, of exceptional purity, in both lump and gravel form; high silica sands for steel foundry use and for use in furnace bottoms, and white silica flour and high silica cement.

A number of booklets, descriptive of their various products, are available at the firm's stand.

The stand will be in charge of Mr. George Senior, head traveller, and Mr. Gilbert Griffiths, Birmingham representative.

Sterling Foundry Specialities, Limited.

Sterling Foundry Specialities, Limited, Sterling Works, London Road, Bedford, are exhibiting a comprehensive selection of Rolled Steel Moulding Boxes of various sizes and styles suitable for both machine and hand-moulding in iron, brass, steel and aluminium foundries.

There are over twenty different standard styles of boxes, which are made in sizes ranging from 9 in. square × 2½ in. deep each part, up to 2 ft × 4 ft. × 16 in. deep each part, also circular boxes from 12 in. to 48 in. dia.

ALL STEEL MOULDING BOX.—MESSRS. STERLING SPECIALITIES, LIMITED.

These boxes are made from a single bar of special rolled channel steel section, accurately bent to the required shape and size as shown in the illustration. All handles, pin-holders, lugs and other attachments are made of malleable iron, and are securely riveted to the sides or ends of the box. This method of construction makes an exceptionally strong moulding box. Boxes arranged with bars are exhibited, also boxes with various pin arrangements. The exhibit is very complete, and practically every foundry requirement in this line is catered for.

Bradley & Foster, Limited.

From their furnaces at Darlaston Messrs. Bradley & Foster have collected a representative series of fractures of pig-irons, comprising refined malleable; cylinder iron for light work; cylinder iron for hydraulic, steam and oil engine work; chilling iron and refined cold blast quality of which the brands R.A.M., D.M.R., and I.X.L. have a world-wide reputation. Results given by the iron, both raw and as finished castings, form an interesting feature, whilst the tests on malleable, both before and after annealing, are of great practical value.

The stand will be in charge of Mr. C. B. Richards, of Hill Top, West Bromwich, the Midlands representative, and he will be assisted by a full technical staff.

Frederick Mountford (Birmingham), Limited.

The head office of this concern is at Fremo Works, Moseley Street, Birmingham. They are showing a number of foundry specialities of considerable interest. Modern foundry conditions make it imperative that the fitting box parts must be as near perfect as possible. It is with this in mind that this firm has developed a special line covering taper pins, steady pins and box pins. Mr. Frederick Mountford, the governing director, will be in charge of the stand.

MACNAB & CO.

Tabor Patent Portable Combination "Shockless" Jarring Roll-over and Pattern-Drawing

MOULDING MACHINE.

BRITISH BUILT

Box and Mould—after being Rammed—in position of being Rolled over.

Special Features and Advantages.

Sand jar rammed by "Shockless" device—Tabor Patent—without shock to the machine or surrounding moulds.

* **Machine not restricted to use of one size moulding box—any size can be used up to load capacity of machine.**

Good surface castings.

Pattern plates can be changed instantly without unfastening mechanism so that comparatively small quantities can be made economically.

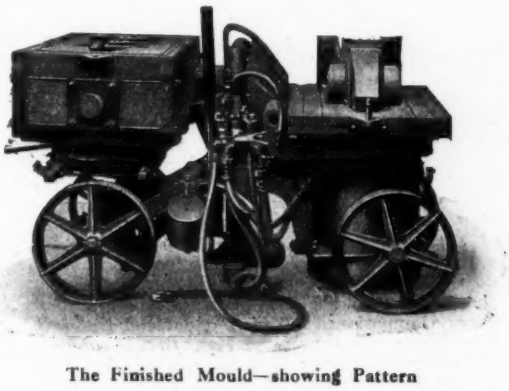
Perfectly straight draw ensured by mechanical guides of large surface to prevent wear and retain accuracy.

All moulds jar rammed in a few seconds and thoroughly uniform in density, ensuring minimum quantity of defective castings and less blow holes.

"All operations other than sand filling are completed in two minutes for any size of work within capacity of machine. To realise what this means, compare your present wage cost for the same work!"

CAPACITY.

SIZE	* Size of Moulding Box.	Straight Pattern Draft.	Nett Weight of load that can be rolled over at 80lbs. pressure.
18	18 in. wide. 36 in. long. 12 in. deep.	8 in.	450 lbs.
24	24 in. wide. 48 in. long. 15 in. deep.	10 in.	800 lbs.



The Finished Mould—showing Pattern after being drawn.

We make various models and sizes for all types of machine moulding, according to class of work and numbers.

SEND US DRAWINGS OF YOUR WORK FOR SPECIFIC EXPERT ADVICE,
. . . . ACCORDING TO YOUR CONDITIONS AND QUANTITIES. . . . .

56/8, EAGLE ST., SOUTHAMPTON ROW, LONDON, W.C.1.

WORKS, TOTTENHAM, LONDON, N.17.

Code: Western Union.

William Cumming & Company, Limited.

This firm, who have their head office at Kilvinvale Mills, Maryhill, Glasgow and works at Falkirk, Chesterfield, Middlesbrough and Bilston, are the largest firm of iron foundry blacking manufacturers in Great Britain.

Possibly the most universally used commodities in the foundry world are the various facings required for service in the moulds in order to combat the heat and render less impervious to the disintegrating element the sand and other materials used for the formation of the moulds. It is almost safe to say that these productions are really the least understood in the foundry, and there are even to-day many moulders who are not definitely sure of the functions performed by these refractories, and the enormous amount of care which should be exercised in their selection. In fact, in no section of the foundry is the old rule-of-thumb method so much in evidence as in this particular connection. During the past decade considerable strides have been made in the direction of the enlightenment of the foundryman, and lately the number of his would-be advisers has increased exceedingly. One almost is inclined to say that the subject is being overdone, very frequently by people who have given little or no study to the points involved, but even more frequently perhaps by individuals who, while specialising either from the technical or practical side, have omitted the very necessary qualification of a combination of the two, and so frequently lay down hard and fast rules, which upon production are found to fall short of the required finality.

It is pleasing to find, however, that some firms are giving much closer attention to the whole subject than was formerly the case, and in this connection the remarkable developments of the firm of Wm. Cumming and Company, Limited, who justifiably claim to be the the largest manufacturers of ironfounders' facings in the country, can be noted. Founded as long ago as 1840, in the neighbourhood of Denny, this firm commenced in a very small way, but soon moved to Maryhill, Glasgow, and from that time has steadily increased in size till they have now five establishments, two in Scotland and three in England, with general works in four towns and office and warehouse in a fifth, where land has been secured in order to erect new and even more up-to-date works than they have at present.

The plant and machinery of the Company has been brought completely up to date, and all the works are, or will shortly be, driven by electricity, the only plant at the moment remaining under steam being Deepfields, which is now in the transition state. The milling plant at each works is very extensive, and some of the individual machines are capable of turning out 20 tons of very fine material every working day. It can be easily realised, therefore, what an enormous total annual production can be achieved with a battery of such machines. In order to make matters secure from both the points of view of quality and standardisation, laboratories have been set up, and frequent analyses are made by the Company's own staff of all in-coming goods, on raw materials, and of out-going manufactured articles.

Last year the firm had the misfortune to lose by death its Chairman, Mr. Wm. Cumming, a thoroughly practical miller who had had many years of experience in different parts of the world. His place as Chairman and Managing Director was taken by Mr. Harry Winterton, whose knowledge of foundry practice and the requirements of the moulder is admitted on all hands, and whose Papers to various branches of the Institute of British Foundrymen have always been received with considerable interest. He is assisted by Mr. Frank E. McGrah, the Vice-Chairman, who is in charge of the Deepfields Works; by Mr. John Hamilton, the Director-in-Charge, at Chesterfield; by Mr. John Stewart, the Director responsible for the running of Falkirk Works; and by Mr. T. Fitzpatrick, who controls the Works at the Head Office at Maryhill. The Secretary of the Company is Mr. John Gemmell, whose services extend into well over 30 years, while Mr. R. C. Waddell, another Director, takes charge of the outside representation in Scotland and Ireland. A large staff of travellers represents the firm in various parts of the country, and periodical visits are made to customers in our Colonies and foreign countries, a large number of whom find it convenient to send home for goods upon which they can place the utmost reliance. The exhibit includes a complete range of plumbagoes, blackings, coal dust, core gum, terra flake, steel paint and moulder's composition.

The Shotts Iron Company, Limited.

This well-known firm, whose head office is at 1, Castle Street, Edinburgh, are showing 3 cwt. of each quality of Shotts Brand pig-iron in quarter pigs, one piece of each quality being machined on one side and polished on the other. In order to demonstrate the quality of the castings produced from Shotts pig-iron, they are exhibiting boiler castings, from No. 1 pig-iron; electric motor castings, from No. 3 soft pig-iron; gas-governor castings, from No. 3 medium pig-iron; and L.P. cylinder, 38 in. dia. × 27 in. stroke, for a triple-expansion marine engine, and a slide valve for an L.P. cylinder, from No. 3 hard pig-iron; a spring ring for a marine engine, 72 in. dia., from No. 4 soft pig-iron; and a H.P. cylinder liner, and a crusher jaw, both of which contain a large proportion of No. 4 hard pig-iron. Gun-metal castings are represented by a number of 4 in. and 6 in. treble ram pumps.

Mr. John Jenkins, the firm's foundry manager, is in charge of the stand.

Necol Industrial Collodions, Limited.

Necol Industrial Collodions, Limited, of Windsor House, Victoria Street, London, S.W.1 (a constituent company of Nobel Industries, Limited), are showing a number of exhibits illustrating their "Necol" products of direct interest to the engineering and allied trades.

Perhaps the most interesting product is "Necol" Plastic Wood, a mouldable material which, on exposure to the air, hardens into a tough waterproof substance and can then be worked with ordinary tools like wood. The exhibits include engineers' patterns showing the application of this material for filleting, repairing and renovating old patterns and rendering worn or broken castings suitable for patterns, and a number of pressed and moulded examples.

"Necol" Glossy Cellulose Enamels, which are of peculiar interest to the engineering and allied trades, are displayed in white, black and all colours. These spraying enamels are quick or air-drying and give a high glossy finish requiring neither stoving, varnishing nor mop-polishing. A number of rough castings treated with "Necol" Glossy Enamels as well as some metal goods, to demonstrate the uses of them for high-grade work, are shown.

"Necol" Cellulose Lacquers for protecting bright metal work of every description are also exhibited.

Smeeton-Wright Furnaces, Limited.

This firm, whose offices are at St. Stephen's House, Victoria Embankment, S.W.1, have an extremely interesting exhibit of Continental foundry specialities. They include the Schurrman cupola, Gutman moulding machines, Gutman sand-blast apparatus, Meyer tapping device, Chantraine metallurgical furnaces, and Collin foundry ladles. These will be fully illustrated and described in our next issue. Mr. John Smeeton is in charge of the stand, together with the local representatives of Messrs. Turnbull & Company.

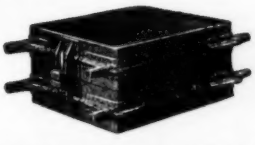
Parliamentary Notes.

Pneumatic Tools Alleged to Injure Health.

MR. B. SMITH asked the Home Secretary last week whether his attention had been called to the injury to health suffered by men using pneumatic tools; and whether he would cause an inquiry to be held into the matter?

MR. HENDERSON said that he recently had received a communication on this subject from the Transport and General Workers' Union, but no definite evidence of injury had so far been furnished. He would be glad to receive particulars of actual instances of workmen who have suffered injury to health from this cause with a view to facilitate inquiry.

Sterling



STEEL BAR SECTIONS OF STERLING ROLLED SHOWING THE SOLID RIB AND STIFF SAND LEDGES.

STEEL BAR SECTIONS OF STERLING ROLLED SHOWING THE SOLID RIB AND STIFF SAND LEDGES.

FOUNDRY EXHIBITION

Bingley Hall, BIRMINGHAM

June 19th to 28th.

We are Exhibiting a representative selection of our Rolled Steel Moulding Boxes. No Foundryman should fail to call at our Stand

EXHIBIT No. 55.

STERLING FOUNDRY SPECIALTIES, LTD

LONDON OFFICE: 13, VICTORIA ST., S.W1.. Sterling Works, Bedford.

GANISTER, CUPOLA BLOCKS, FIRE BRICKS, FIRE CLAY.

Silica Bricks, Tuyeres, Stoppers, Nozzles, &c.

STEEL MOULDERS' COMPOSITION, SILICA CEMENT.

J. GRAYSON LOWOOD & Co., Ltd.,

DEEPCAR, nr. SHEFFIELD.

Telegrams: "LOWOOD, DEEPCAR."

SIEMENS' STEEL PROCESS

BOILER, SHIP and BRIDGE PLATES, etc. ANGLES and all forms of Sectional Bars. TYRES and AXLES to all requirements. CASTINGS of all kinds and of Largest Sizes. FORGINGS of every description. BILLETS, BLOOMS, RAILS.

SPECIAL STEEL FOR CONSTRUCTIVE PURPOSES.

The STEEL COMPANY OF SCOTLAND, Ltd.

Head Office: 23, ROYAL EXCHANGE SQUARE, GLASGOW.
Works: HALLSIDE, NEWTON and BLOCHAIRN, GLASGOW.

CONTRACTORS TO HOME, COLONIAL AND FOREIGN GOVERNMENTS.

Established 1872. *Telegraphic Address: "Steel, Glasgow."*

Trade Talk.

THE INSTITUTION OF STRUCTURAL ENGINEERS is forming a Yorkshire branch.

MACLEOD & COMPANY, iron ore merchants, etc., have removed from 41, St. Vincent Street, to 94, Hope Street, Glasgow.

THE BIRTLEY IRON COMPANY, Birtley, Co. Durham, are carrying out extensive improvements at their works, including a new structural shop.

A. NORRINGTON & COMPANY, LIMITED, scrap iron and metal merchants, 1, East India Avenue, have removed to 20, St. Dunstan's Hill, London, E.C.3.

AFTER NEGOTIATIONS, the iron and steel makers have agreed to concede 1½d. per hour increase in wages to all bricklayers' labourers employed in the iron and steel works on the North-East Coast.

AFTER BEING IDLE since March, the Barrow Hematite Steel Company, Limited, resumed operations again last week. Two furnaces will be re-lighted, and the steel works will restart as soon as possible, perhaps in a week or ten days.

THE UNIVERSAL SYSTEM OF MACHINE MOULDING & MACHINERY COMPANY, LIMITED, 97, Queen Victoria Street, London, E.C.4, have appointed Mr. M. L. Simpson, of 8, Queen's Gardens, Dowanhill, Glasgow, to be agent for Scotland for the sale of the company's machines in that area.

WITH the object of enabling engineers and others to inspect the new buildings of the Faculty of Engineers, which has just been completed, an Engineering "At Home" was held at University College, Gower Street, London, recently. The buildings will be formally opened at a date to be arranged in the near future.

THE SUMMER MEETING of the Institution of Heating and Ventilating Engineers is to be held at the Langham Hotel, Regent Street, London, W., on Tuesday, June 24, 1924, at 9.30 a.m. The agenda includes papers on "Research Work: Its Past, Present and Future," by Mr. E. Herring, and "Oil Fuel as applied to Central Heating," by Mr. A. F. Baillie.

OWING TO CONTINUED EXPANSION OF BUSINESS, Allen-Liversidge, Limited, have found it necessary to move into larger and more convenient offices. The address of their head offices will in future be Victoria Station House, Westminster, S.W.1. The lighting, heating and power installation department remains as before at 123, Victoria Street, Westminster, S.W.1, where the company's showrooms will also be situated.

DURING THE PAST MONTH or so United States producers of pig-iron have experienced new competition in the home market from the Netherlands. Considerable quantities have reached the Pacific Coast, and a large shipment is going to New England of this iron, which is stated to be of excellent quality. The blast-furnace plant is situated near Amsterdam, and was built for Dutch interests by the Chicago firm of Freyn, Brassert & Company.

THE WALLSEND SLIPWAY & ENGINEERING COMPANY, LIMITED, have just completed the trials of their Wallsend-Sulzer Diesel engine. The engine is a two-stroke air injection oil engine, having four cylinders 600 m/m bore x 1,200 m/m stroke, designed to develop a B.H.P. of 1,800 at 90 revolutions per minute on service, and is intended for a single screw vessel. The trials consisted of a non-stop run of 60 hours at full power; a 6 horse 10 p.c. overload test, and further runs of a demonstrative nature.

THE BIRMINGHAM CORPORATION have decided to adopt Lopulco pulverised fuel for their new extensions at Nechells Power Station, and have just placed the order accordingly. The exact details are not available, but it is understood that the new plant will consist of 6 Vickers-Spearing water-tube boilers, with a capacity each of 35,000 lbs. of water per hour, at 320 lbs. per square inch steam pressure, and 700 deg. F. total steam temperature, the heating surface of the boilers being 5,400 square feet. The Underfeed Stoker Company, Limited, are also supplying for each of the boilers four Lopulco triplex burners fed by self-contained 4-group adjustable speed feeders.

THE ATLAS METAL & ALLOYS COMPANY (1921), LIMITED, were again invited by the Royal School of Mines to exhibit their anti-friction metals on the occasion of the reception by the Rector of the Imperial College to meet the delegates of the Empire Mining & Metallurgical Congress, London, on June 3. In addition, a collection of bearings kindly lent for the occasion by several leading engineers demonstrated the durability of these alloys. One exhibit was a Gwynne pump crank pin bearing fitted with Tenaxas A.1 plastic metal taken from the s.s. "Ingoma," after being in service 11 years and still in working order. Another exhibit was a set of tramway armature bearings, four in number, lined with W. E. Watson's marine bearing metal, having a service of nine months and a mileage of 30,000, together with a set of tramway traction bearings fitted with B.T.H. metal, average service of which was four years and nine months, and the mileage 115,000.

Mr. H. A. J. Rang Resigns Honorary Secretaryship.

Mr. H. A. J. Rang has resigned the position of honorary secretary of the Newcastle and District Branch of the Institute of British Foundrymen. Mr. Rang was responsible for the establishment of the local branch, and has acted as honorary secretary for thirteen years, during which period the membership has grown from five or six to nearly 300, and is one of the most successful branches in the country. Owing to personal and business engagements, Mr. Rang is unable to carry on the secretarial work of this important branch, and has therefore, with much regret, felt it necessary to resign in order that someone with more leisure can be appointed to carry on the work.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Institute of British Foundrymen—Status of Membership.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Having just spent a glorious time at the Newcastle conference, it has occurred to me that the General Council are taking a wrong position with regard to applications for membership from persons engaged in selling materials to the foundry trades. I found that a large number of members present at the meetings were those who had something to sell, and it would appear that if the General Council's interpretation of the rule affecting new members is not made elastic, the firms who cannot obtain membership will take the cream of foundrymen already members into their employ and thereby defeat the end which General Council have in mind. I should like to hear the views of other members.—Yours,

"LANCASTRIAN."

Photographs taken at the Newcastle Convention.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—A number of photographs were taken during the Convention and published in the "Newcastle Illustrated Chronicle." They included several taken at the Garden Party, one at the Ladies' Lunch, one in the Conference Hall, and one of the President and chief guests at the Banquet.

Any members desiring copies may obtain them from the Manager, Photographs Department, "Chronicle" Office, Newcastle-on-Tyne, at the following prices, and remittance should be sent with order:—

Size.	Mounted.	Unmounted.
8 in. × 6 in.	1s. 6d. each.	1s. 0d. each.
10 in. × 8 in.	2s. 0d. each.	1s. 6d. each.
12 in. × 10 in.	2s. 6d. each.	1s. 9d. each.

I am, etc.,

COLIN GRESTY.
Hon Sec.
Convention Committee.

Monkseaton.
June 14.

Obituary.

MR. F. J. BROADBENT, a director of Thomas Broadbent & Sons, Limited, of Huddersfield, died recently.

MR. E. P. REYNOLDS, a former director of the Hardy Patent Pick Company, Limited, died recently in his 61st year.

MR. C. H. BUTTERWORTH, a director of C. H. Butterworth (Bury), Limited, ironfounders and engineers, Railway Foundry, Buckley Wells, Bury, died recently, aged 68.

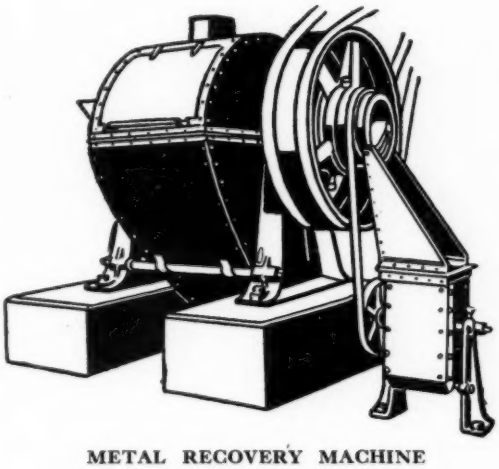
MR. ANTHONY HOMER, of Lichfield Road, Rushall, died recently at the age of 72 years. He was the senior partner in the firm of Anderson & Homer, malleable iron founders, of Frederick Street, Walsall.

THE BUSINESS formerly carried on by Mr. D. Flanagan, Cochrane Street, Irvine, brassfounder, has been transferred to D. S. Flanag and T. B. Flanagan, brassfounders, Cochrane Street, Irvine, who will carry it on on their own account, are authorised to uplift all debts due to the said D. Flanagan, and they will discharge the whole debts and liabilities due by him in connection with the business.

Telegrams: "THROWER, GLASGOW." Telephone: 5909 CENTRAL.

ALBERT SMITH & Co FOUNDRY ENGINEERS. TOOLS & EQUIPMENT

Head Office: 60, St. ENOCH SQUARE, GLASGOW.



METAL RECOVERY MACHINE WITH MAGNETIC SEPARATOR.

OUR

BRASS RECOVERY MACHINES

are the last word in the Treatment of Brass Foundry

ASHES AND SKIMMINGS.

If you don't want to lose what your Competitor is saving, you must write to us about it now.

We are at your Service.

You will find

The SIROCCO TRADE MARK Fan

at Wembley

Palace of Engineering.. Stand No. 142 — There is a "Sirocco" Fan for every purpose for which a Fan can be employed and examples of a wide range of these Fans can be seen on our stand.

Exhibition .. Colliery .... — The Exhibition Colliery is ventilated by a full size "Sirocco" Mine Fan of the Double Inlet Type.

Exhibition .. Power House — The Draught for the Boilers in the Exhibition Power House is furnished by "Sirocco" Fans.

DAVIDSON & CO., LTD.

Sirocco Engineering Works,

LONDON BIRMINGHAM MANCHESTER CARDIFF **BELFAST** GLASGOW BRISTOL NEWCASTLE-ON-TYNE

IRON AND STEEL MARKETS.

Pig-iron.

MIDDLESBROUGH.—The resumption of business after the Whitsun vacation has had little effect upon the Cleveland iron market, which continues dull and inactive all round, dealings on home account being of a very desultory character. Consumers have fair stocks, having regard to the work on hand and in view, and with the market weakening there is no inducement to buy at the moment. Values remain very much the same as previously quoted, though with a further sagging tendency. No. 3 G.M.B. can be done without difficulty at 90s., No. 1 is 95s., No. 4 foundry 89s., and No. 4 forge 88s. per ton.

It is perhaps premature so soon after the holidays to look for much change in the hematite position one way or the other. Certainly the recent weakness is quite maintained, and values have sagged even further. Last week 98s. was a nominal quotation for East Coast mixed numbers, but on Tuesday 97s. 6d. was quoted, and even this could be shaded for a substantial parcel. The premium for the No. 1 quality is unchanged at 6d. to 1s. per ton. In West Cumberland and North Lancashire prices are fairly steady, with Bessemer mixed numbers 107s. 6d. per ton delivered at Glasgow, 112s. 6d. at Sheffield, and 117s. 6d. at Birmingham. Low-phosphorus iron is steady.

LANCASHIRE.—The majority of consumers' works in this area, having made a belated start after the holidays, transactions in foundry pig have been few and unimportant this week. As far as reports can be verified, some Derbyshire No. 3 iron has been offered here at 100s. 6d. per ton, but the more general price in Manchester is 101s. 6d., and this is about the cost of Northamptonshire No. 3. Scotch foundry iron seems rather weaker again, and good brands could be bought in Manchester at 113s. to 114s. per ton delivered.

THE MIDLANDS.—With demand continuing on a restricted scale, the prices of all grades of pig-iron were easier, and it was reported last week that Northants No. 3 iron had been offered at 87s. 6d. at furnaces, whilst certain Derbyshire and Staffordshire irons were obtainable at 92s. 6d. f.o.t. Even these reduced prices did not bring much business. Current quotations are as indicated below:—Derbyshire No. 3 foundry, 92s. 6d. to 95s.; Staffordshire No. 3 foundry, 92s. 6d. to 95s.; Northants No. 3 foundry, 87s. 6d. to 90s.

SCOTLAND.—Movement in the Scottish markets for foundry pig continues quiet and featureless, with prices inclined to an easier tendency. Under these conditions No. 3 Scotch can be bought to-day at 98s. per ton at the furnaces. There is, however, no improvement in the way of fixing up contracts, buyers being content to take a short view and buying only for their immediate requirements.

Finished Iron.

The demand does not expand. Marked bar houses in South Staffordshire report that they are steadily employed, and the output of the better grades of unmarked is maintained, but the quantity being produced is still very much below the capacity of the district, and there seems no way of increasing it to its former level. On the whole, the quotation for these qualities is very steady indeed. Producers assert that there is too little profit in the business, although prices are so high, to enable them to give way; but for an attractive order some of them would make slight concessions. Where smaller miscellaneous quantities are concerned, they are very firm. Makers of commoner bars are still severely troubled by foreign competition at prices about £3 10s. less than they are quoting, but they are still of opinion that it pays them better to let business pass than to attempt the impossible task of competing with the foreigner. Iron strip is in much the same case, only in this instance the competition comes from steel strip produced from very cheap imported billets. They cannot compete with this material except where quality is essential.

Steel.

While most of the steelworks are fairly well provided with specifications for the time being, there is unfortunately little stirring in the way of new business. The wagon works in the Midlands continue quite busy, and some good orders for steel have been given out by them recently. The makers of thick plates are only very moderately engaged, but still adhere to the price of £10 5s. delivered, and it is not possible to get under this figure. Sections and joists have been sold in this district at £9 10s., but the general figure is £9 15s. As previously reported, billet makers are having to cut their prices very fine to secure the limited quantity of business available. For a good order £9 12s. 6d. would be accepted for carbon billets, but £7 15s. would appear to be the lowest figure acceptable for soft Siemens' steel. The absolute stagnation in the demand for ferro-alloys is still maintained, and the prospects of increased requirements are as remote as possible. Probably the situation is due, to a certain extent, to the recent holiday period, and there may be a revival shortly. General indications suggest that, whilst business is not brisk, prices are steady in tinplates, with some of the makers who were not in favour of the recent reduction of the minimum to 22s. 7½d. still holding out for 23s. basis I.C. f.o.b. works port.

Scrap.

Corresponding with the conditions above outlined in the pig-iron trade, business in scrap metal is again on a limited scale. In Lancashire the demand for foundry scrap is negligible in volume, but the tone of the market seems steady enough. As it is unlikely that pig-iron can be very much cheaper, foundry scrap ought not to fall much below 90s. in Manchester. Dealers are now usually quoting this price and 92s. 6d. for special lots, and it is thought possible that when the foundries are again in full operation, there may be a better demand for broken machinery iron. In Scotland, machinery cast-iron scrap for foundries in handy pieces is, if anything, easier, on account of the poor demand, and stocks generally at hand, combined with the easing in the price of pig-iron and the competition from the Continent. The price nominally is around 95s. to 97s. 6d. per ton, but sellers seem to be more in evidence at these figures. Ordinary cast-iron scrap in handy pieces is 3s. 6d. to 5s. per ton less, but the demand is also poor.

Metals.

Copper.—Recent movements in the market for standard metal indicate a steadier tendency in buying for home consumption, and a fair volume of business has been passing. The position of copper of late has been overshadowed by forced realisations of metal on the Continent, where the liquidation of the big speculative account built up earlier in the year continues to cause a serious amount of financial disorganisation. The American statistical position is, however, considered sound, and evidence of the curtailment of output, not only by the American mining companies, but also by the largest South American producer, would seem to encourage sentiment a little at the current low level of prices.. Current quotations:—*Cash*: Thursday, £61 5s.; Friday, £61 5s.; Monday, £61 15s.; Tuesday, £61 10s.; Wednesday, £61 2s. 6d. *Three Months*: Thursday, £62 2s. 6d.; Friday, £62 2s. 6d.; Monday, £62 12s. 6d.; Tuesday, £62 7s. 6d.; Wednesday, £62.

Tin.—Conditions in the standard tin market of late have assumed a fairly steady aspect, the tendency of values inclining to firmer figures with, at times, movements favouring slightly advanced quotations. Buying on American account, however, continues in restricted volume, while, on the other hand, home industrial consumption indicates some slight improvement. The progress of the world's consumption is still considered satisfactory, despite the usual slackening off to be expected over the summer months. While the supplies on this side are limited and very well held, it must be remembered that the stocks in the hands of the Eastern "pool" are now barely 5,000 tons and that such tin is for the moment withheld from the market. Current quotations: *Cash*: Thursday, £217; Friday, £218 5s.; Monday, £222; Tuesday, £226; Wednesday, £223 5s. *Three Months*: Thursday, £217; Friday, £218 5s.; Monday, £221 15s.; Tuesday, £225 15s.; Wednesday, £223.

Spelter.—The increased firmness in this metal recently reported has been maintained, with a tendency to still higher values. Continental smelters have manifested a little more disposition to meet the market, but only moderate sales are recorded. Current quotations: *Ordinary*: Thursday, £31 18s. 9d.; Friday, £32 5s.; Monday, £32 5s.; Tuesday, £32 3s. 9d.; Wednesday, £31 18s. 9d.

Lead.—In the market for soft foreign pig, the tightness of prompt metal has in no way abated, and the strong control exercised over the market is emphasised by the large importation of this metal which took place last month. Consumption continues good, and shows no signs of falling off at present. Current quotations:—*Soft foreign (prompt)*: Thursday, £32 10s.; Friday, £32 15s.; Monday, £32 17s. 6d.; Tuesday, £32 12s. 6d.; Wednesday, £32 5s.